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ARCHITECTS AND BUILDERS

PUBLISHED
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HANDBOOK

FOR

ARCHITECTS AND BUILDERS

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CHARLES R. ADAMS,
EDITOR.

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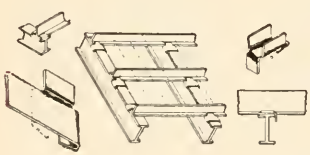
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PREFACE.

THE present volume is issued under the auspices of the Officers and Directors of the Chicago Architects' Business Association, and is intended to bring the Association more prominently before the profession by setting forward the reason for its existence and by explaining what it aims to accomplish. The writer to whom the work has been intrusted has resolved to make the book one that shall contain such useful information (apart from the original object) that it will be a necessity to everyone engaged in the planning or in the erection of buildings.

Lists of members of the Association, of licensed architects, of the Illinois Chapter of the American Institute, and of kindred organizations, have a place. The building ordinances are indexed in an intelligible manner, so that the seeker for something in its pages may find what he looks for without loss of time, trouble and unnecessary reading. Other city ordinances are given. The code of practice adopted by this Association, and rules for the measurement of mason work and plastering, are treated, and a considerable amount of ever-needed information in everyday practice occupies many pages.

With the above introduction, the book is presented with the hope that it will prove of valuable service and save the time of the user by supplying in a simple and compact form data for which he would otherwise search many books.

Yours very truly,

H. B. WHEELOCK,
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} Committee on Publication.

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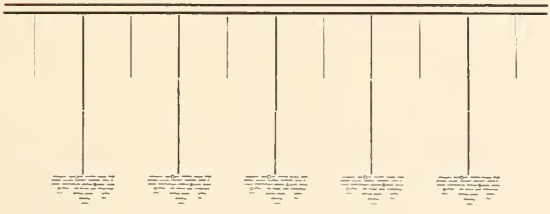
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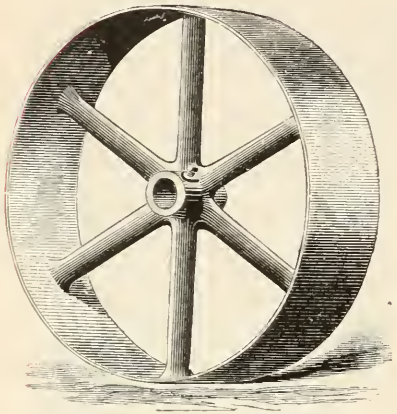
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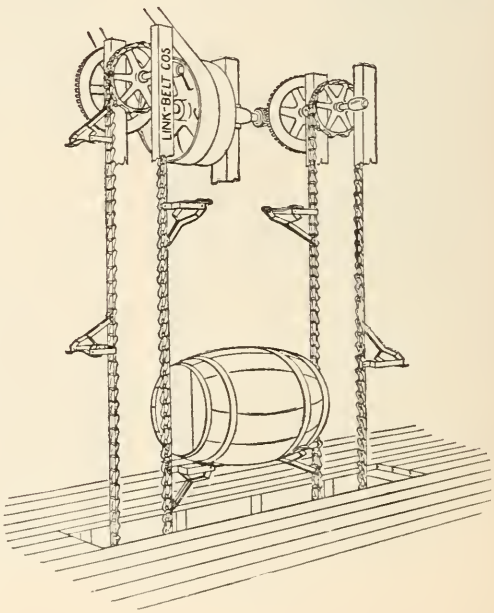
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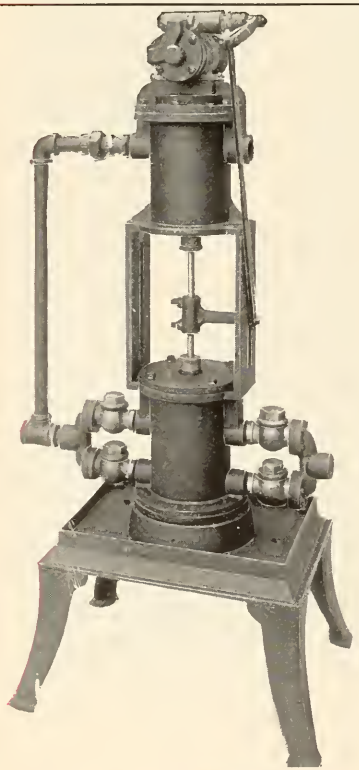
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Chicago Architects' Business Association.

INCORPORATED JUNE 25, 1897.

Those familiar with the enterprise of Chicago will not be surprised at the development of something new in the line of architectural societies. The original organization — the Illinois Chapter of the American Institute of Architects— has endeavored to cover the entire field of an Architect's activities, comprising such diverse topics as art, engineering, sanitation, building materials, professional ethics and matters of a purely business nature. It is well known that an individual architect cannot hope to excel in all these many departments, hence the resort to partnership and the employment of skilled subordinates and special experts. It is no wonder, then, that a society should experience difficulty in handling artistic and business problems with success in both directions.

The business problems confronting Architects require the support of large numbers, and a society must comprise practically the whole profession ; but in the discussion of matters more purely æsthetic, quality is more important than quantity, and an increase of membership might lower the standard of attainments or bring together inharmonious elements, and thus become a source of weakness rather than of strength. This possibility has been recognized in the debates of the American Institute of Architects, where one member has urged measures for a numerical increase and another has replied that the membership is already too large.

The Chicago Architects' Business Association proposes to avoid the difficulty under which the American Institute has labored by limiting its field of operations strictly to *business* matters, and leaving to the Chapter of the Institute all questions of a purely professional nature. For the purposes of coöperation an Architect's artistic attainments or success in his calling need not be inquired into ; it is sufficient to know that he is a reputable Architect.

Since the passage of the " Bill providing for the licensing of Architects " in this State, the standing of an architect is determined by the State Board of Examiners, and the Chicago Architects' Business Association has voted to recognize the Board of Examiners by admitting to membership all Architects passed by it.

The Association, although but eighteen months old, has already a membership larger than that of any Chapter of the American Institute, and can with propriety claim to represent the profession in Chicago.

No fact so clearly proves the timely birth of the new association as the welcome it has received from the Chapter of the Institute. So far removed has the Chapter been from jealousy of this as a rival organization that it has given, gratuitously, the use of its rooms, and has aided the Association by recognizing its right to represent the profession in business interests, thus practically turning over to the Association the management of such matters.

While acknowledging with thanks the coöperation of the Chapter for the many courtesies extended, this Association feels that the Chapter will have its

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hands free for work in other lines tending to the uplifting of the profession, and congratulates it upon its recent action, that of identifying itself with the Art Institute by securing rooms in its building, and trusts a new and illustrious career has been inaugurated. It will be the part of the Business Association to provide the sinews of war, without which the higher aspirations of the profession would be but an empty honor.

It has been felt on all sides that a strong and influential association outside the Chapter could be built up whose every move would be a power in the right direction, and with this object in view the Chicago Architects' Business Association was inaugurated and the following definite policy and immediate plan of action were outlined and agreed upon :

1. To protect the public against improper and insufficient plans, and the Architects against the competition of those who are incompetent to practice as Architects, by —

 a Securing a State law requiring the licensing of Architects.

 b Procuring the passage of a City ordinance which shall define a standard to be observed by persons applying for building permits and so give the Commissioner of Buildings power to reject such plans as are imperfect.

2. Coöperation with contractors to secure —

 a A uniform contract.

 b Uniform method of taking bids and letting work.

 c Uniform method of arbitration of Architects' decisions.

 d Standard of plans and specifications.

 e Protection against disreputable methods of business, whether among Architects or Contractors.

3. Protection of clients and Architects from the annoyance and loss occasioned by the present Mechanics' Lien Law, by securing such changes in the same as may be considered desirable in the interests of all concerned.

4. To maintain at all times a conservative policy in its relation with Contractors and Contractors' Associations, so that its influence will be felt by them without the necessity of resorting to combinations suggestive of trades-unionism, thus being independent, to act without reserve, in order to promote the best business interests and efficiency of the Architects in general in this city.

How far the policy outlined above has been adhered to is evident.

The State law for the licensing of Architects has been placed upon the statute book and has entered upon its career of permanent usefulness. That the law as it stands is absolutely perfect it would be premature to say ; with thoughtful revision it must prove a great power toward the advancement of the architectural profession. Illinois has much to be proud of, inasmuch as with comparatively no opposition she carried through a measure which had met with signal defeat in New York and elsewhere. That such a measure was needed there can be no doubt, and it remains with the Architects themselves to see that the full benefit of the proffered usefulness should accrue.

The second matter suggested and carried to a successful issue, "the procuring a City ordinance defining a standard to be observed by persons applying for building permits," is undoubtedly a great step in the right direction. Permits have hitherto been granted to anybody, irrespective of the professional standing of the applicant and regardless of the perfection or accuracy of the plans submitted. It is hoped the Commissioner of Buildings will see that the rights of the Architects are protected, that the State law is respected, and that the standard

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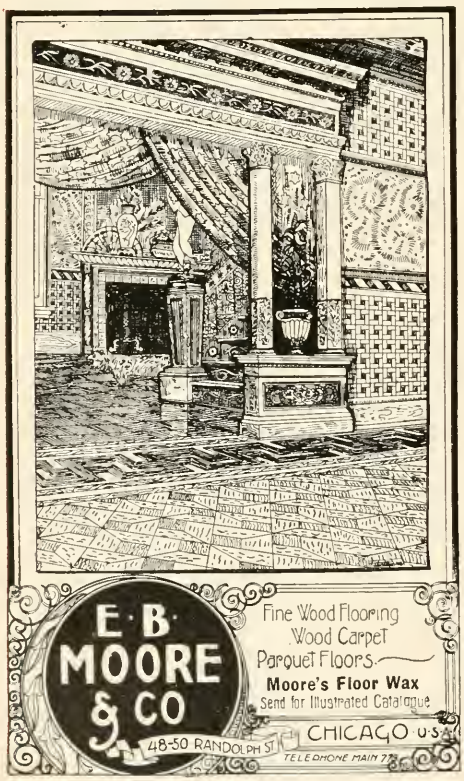
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called for by the Building Ordinance shall be lived up to. Such being achieved, the efforts of this Association will not have been in vain.

This Association has given considerable time and thought to the framing of a uniform contract which shall be acceptable to both Architects and Contractors.

A code of practice has been adopted to govern the methods to be observed by Architects in the matters of drawings, specifications, supervision of work and rules for letting contracts. A copy will be found in this volume. The code has met with general approval.

The standard laid down by the Association for the making of plans and specifications has been adopted by the revisers of the Building Ordinances, and, if insisted upon, should result in materially raising the qualifications of Architects and bring about incalculable benefits.

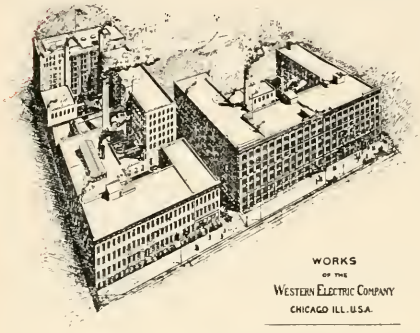
The several legal forms and certificate blanks in line with the requirements of the Lien Law have been prepared, and are now in the hands of the printer. It is hoped they will be used not only by the profession in Chicago, but by licensed Architects throughout the State. The forms will be copyrighted and can be obtained from the Secretary.

During the year several very important conferences have been held with leading representatives of the various building and manufacturing associations, at which reforms were discussed tending to the establishment of a sounder and more conservative manner of conducting business. Such interviews are calculated to be of value to all concerned. The Association is at all times willing to hear the other side of the case, and the best interests are served by a discussion of the many and difficult questions involved in the building business. M. Cæsar Daly, in speaking before the Royal Institute of British Architects, said: "That relation once existing between our profession and that true and loyal army of skilled workmen of old, is now year by year becoming less and less recognized by both parties; doubt and suspicion have pushed out confidence and respect." One of the aims of this Association is to bring the two again into closer sympathy.

The future policy of the Association will be, as it has been in the past, on conservative lines; fully appreciating the intricate possibilities constantly presenting themselves, thoroughly weighing and considering the varying topics which must be met in the line of progress, it will give its best and untiring efforts to bring about satisfactory results, and it invites the hearty coöperation of every licensed Architect to join hands and strengthen an institution founded and carried on for the universal success and betterment of the profession.

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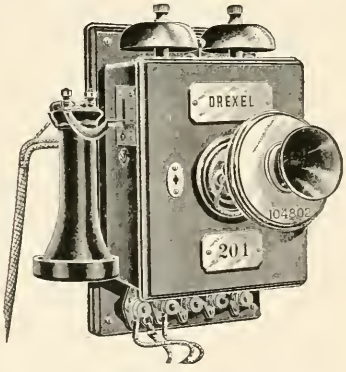


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Code of Practice of the Chicago Architects' Business Association

RULES OF PRACTICE.

DRAWINGS.

SECTION 1. All drawings forming a basis for contracts shall be drawn to a scale of not less than one-eighth of an inch to the foot, in ink or by some other process that will not obliterate. General dimensions shall be accurately figured and the drawings made *explicit* and *complete*.

SCALE DRAWINGS.

SECTION 1. All portions of the work that require a larger scale to illustrate the same shall be drawn full size or to a scale large enough to make them fully set forth what is required by the Architect. No Architect shall ask for bids on any work until all general drawings are complete and sufficient details made, which in connection with the specifications will settle all questions affecting the cost of work.

SUPERVISION OF WORK.

SECTION 1. The supervision of an Architect shall be such as shall require the faithful execution of the work according to the true meaning and intent of the Plans and Specifications, but such supervision does not cover the duties of a clerk of the works. In case there is no clerk of the works provided by the Owner, Contractors must refer any questions about which there can be any doubt to the Architect for decision before proceeding to execute the work.

SPECIFICATIONS.

SECTION 1. Specifications must be prepared in ink or by some permanent process, and shall clearly explain the kind and quality of materials and methods of construction, and give such further information as may be needed to definitely supplement the Drawings.

SEC. 2. Everything that will be required in the work must be mentioned in the Specifications, as far as practicable, being classified and grouped under appropriate headings, and work called for by the Plans and not referred to in the Specifications, and vice versa, shall be included same as if mentioned by both Plans and Specifications, provided such work comes clearly within the branch or branches covered by the contract.

RULES FOR LETTING CONTRACTS.

SECTION 1. Written invitations for proposals will be forwarded Contractors for work to be let, stating when bids will be opened. This does not apply to public work requiring advertisement for proposals.

SEC. 2. Contractors desiring place upon the roster of an Architect's office shall furnish reference as to *mechanical ability and fidelity* and be prepared to furnish a good and sufficient bond.

SEC. 3. Proposals shall be presented on the day set for opening same, and will be opened in the presence of a representative of the bidders.

Proposals shall be opened, read and posted at the time specified before such bidders as are present. Contracts shall be awarded by Owners or Architects within a reasonable time thereafter.

Bidders shall not be held on proposals retained longer than ten days after date of opening.

SEC. 4. The lowest bidder will not be permitted to change the amount of his bid, but must sign contract or withdraw. The right is reserved to reject any or all proposals.

SEC. 5. If, after the opening of bids, changes are made in the Plans and Specifications amounting to not more than 10 per cent, the lowest invited bidder

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shall tender a detailed proposition for said changes, subject to the approval of the Architect and Owner, and if found fairly detailed, the contract shall be awarded to him upon his bid so changed.

SEC. 6. Lack of ability to carry out the work in a proper manner, want of fidelity or disposition to render less than is due the Owner in strict conformity with the terms of contract, shall lay the Contractor liable to be dropped from the roster of the Architect, temporarily or permanently, as in the judgment of the Architect is just and right, and in the interests of his clients.

SEC. 7. Final certificates of payment on a contract shall not be issued by the Architect until the Contractor has returned all Plans and Specifications to the office of the Architect.

H. B. WHEELOCK, *President.*

Adopted September 9, 1897.

C. R. ADAMS, *Secretary.*

Schedule of Charges for Professional Services, Recommended by the Association.

For full professional services (including supervision) 5 per cent upon the cost of the work, except as below stated.

For partial services in case of abandonment or suspension of the work, the charge is as follows: Preliminary studies, 1 per cent. General Drawings and Specifications, 2½ per cent. Details, 1 per cent.

EXCEPTIONS TO ABOVE RATES AS BELOW.

Dwellings costing less than $10,000	7 per cent.
Dwellings costing more than $10,000	6 per cent.
In no case shall the fee for any dwelling be less than $150.	
Hospitals	8 per cent.
Factories	4 per cent.
Warehouses	3 per cent.
Additions and alterations to dwellings	10 per cent.
If less than $1,000	12 per cent.
Additions and alterations to business buildings	7 per cent.
Alterations to store fronts and store fittings	10 per cent.
Designs for furniture	15 per cent.
Designs for inside finish	10 per cent.
Monumental and wrought metal work	15 per cent.

An additional charge will be made for additions and alterations in plans and contracts in proportion to time expended.

Necessary traveling expenses to be paid by the owner.

The Architect's payments are successively due as the work is completed.

Until an actual estimate is received, the charges are based on the proposed cost of the works, and the payments are received as installments of the entire fee.

The Architect bases his professional charge upon the entire cost to the owner of the building, when completed, including all fixtures necessary to render it fit for occupancy, and all old materials used are to be reckoned in cost as if new.

An Architect's duties comprise:

The furnishing of all necessary drawings, specifications and instructions; the general supervision of work and the auditing of all accounts.

Drawings and specifications are the property of the Architect.

Where a special Superintendent or Clerk of Works is required, the expense is to be borne by the owner. He will remain at the works during its progress, and secure the proper fulfillment of the contract. He will be selected by the Architect, to whom he will report.

EXTRA SERVICES.

Consultation fees for professional advice are to be paid in proportion to the importance of the questions involved at the discretion of the Architect, and none of the charges above enumerated cover professional or legal services connected with negotiations for site, disputed party walls, right of light, measurement of work or services incidental to arrangements consequent upon the failure of contractors during the performance of the work.

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AN ACT

TO PROVIDE FOR THE LICENSING OF ARCHITECTS, AND REGULATING THE PRACTICE OF ARCHITECTURE AS A PROFESSION.

Enacted by the Fortieth General Assembly, at the Regular Biennial Session, and Approved June 3, 1897.

SECTION 1. **Appointment of a State Board of Examiners of Architects.**—*Be it enacted by the People of the State of Illinois, represented in General Assembly*, That within thirty days after the passage of this act the Governor of this State shall, by the advice and consent of the Senate, appoint a State Board of Examiners of Architects, to be composed of five members, one of whom shall be a member of the faculty of the Illinois State University, and the other four shall be architects residing in the State of Illinois, who have been engaged in the practice of architecture at least ten years. Two of the said practicing architects appointed as examiners shall be designated to hold office for two years from the date of the passage of this act, and the other two, together with the member of the faculty aforesaid, shall hold office for four years from the passage of this act; and thereafter, upon the expiration of the term of office of the person so appointed, the Governor of the State shall appoint a successor to each person whose term of office shall expire, to hold office for four years, and said person so appointed shall have the above specified qualifications. In case appointment of a successor is not made before the expiration of the term of any member, such member shall hold office until a successor is appointed and duly qualified. Any vacancy occurring in membership of the board shall be filled by the Governor of the State for the unexpired term of such membership.

SEC. 2. **Examiners to file Oath of Office with the Secretary of State—Treasurer to file Bond—Salary of Secretary and Members of Board of Examiners.**—The members of the State Board of Examiners of Architects shall, before entering upon the discharge of their duties, make and file with the Secretary of State the constitutional oath of office. They shall, as soon as organized, and annually thereafter, in the month of January, elect from their number a president and a secretary, who shall also be a treasurer. The treasurer shall file a bond for the penal sum of $5,000, with the Secretary of State, to be accepted by the Governor of the State, before entering upon his duties. The board shall adopt rules and regulations to govern its proceedings, not inconsistent with this act, and a seal, and the secretary shall have the care and custody thereof, and shall keep a record of all the proceedings of the board, which shall be open at all times to public scrutiny. The secretary of the board shall receive a salary which shall be fixed by the board, and which shall not exceed the sum of fifteen hundred dollars ($1,500) per year; he shall also receive his traveling and other expenses incurred in the performance of his official duties. The other members of the board shall receive the sum of ten dollars ($10) for each day actually engaged in this service, and all legitimate and necessary expenses incurred in attending the meetings of said board; said expense shall be paid from the fees received by the board under the provisions of this act, and no part of the salary or other expenses of the board shall be paid out of the State treasury. All moneys received in excess of the said per diem allowance and other expenses provided for, shall be held by the treasurer as a special fund for meeting the expenses of said board, and the cost of an annual report of the proceedings of the State Board of Examiners of Architects.

Provided, however, that when the money in the hands of the treasurer at the time the annual report is rendered exceeds twenty-five hundred dollars ($2,500), the amount of such excess shall be paid into the State treasury, to the credit of the State Board of Examiners of Architects.

SEC. 3. **Quorum—Meetings of Board—Rules and Regulations.**—Three members of the board shall constitute a quorum. Special meetings of the board shall be called by the secretary upon the written request of any two members, by giving at least seven days' written notice of the meeting to each member, reckoning from the day on which the notices are post-marked, telegraphed or personally delivered. The board shall adopt rules and regulations for the examination of applicants for licenses to practice architecture, in accordance with the provisions of this act, and may amend, modify and repeal such rules and regulations from time to time. The board shall, immediately upon the election of each officer thereof, and upon the adoption, repeal or modification of its rules of government or its rules and regulations for examinations of applicants for licenses, file with the Secretary of State, and publish in at least

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one architectural journal and one daily newspaper published in the State of Illinois, at least twice, the name and address of each officer, and a copy of such rules and regulations, or the amendment, repeal or modification thereof.

SEC. 4. **Examinations — Applicants for License to Pay a License Fee of $15 — License Fee, $25.**— Provision shall be made by the board hereby constituted for holding examinations, at least twice in each year, of applicants for license to practice architecture, and any person over twenty-one years of age, upon payment of a fee of fifteen dollars ($15) to the secretary of the board, shall be entitled to an examination for determining his or her qualifications. All examinations shall be made directly by said board, or a committee of two members delegated by the board, and due notice of the time and place of the holding of such examinations shall be published, as in the case provided for the publication of the rules and regulations thereof. The examination shall have special reference to the construction of buildings, and a test of the knowledge of the candidate of the strength of materials, and of his or her ability to make practical application of such knowledge in the ordinary professional work of an architect, and in the duties of a supervisor of mechanical work on buildings, and should also seek to determine his or her knowledge of the laws of sanitation as applied to buildings. If the result of the examination of any applicant shall be satisfactory to a majority of the board, under its rules, the secretary shall, upon an order of the board, issue to the applicant a certificate to that effect, and upon payment to the secretary of the board by the candidate of a fee of twenty-five dollars ($25), he shall thereupon issue to the person therein named a license to practice architecture in the State, in accordance with the provisions of this act, which license shall contain the full name, birth-place and age of the applicant, and be signed by the president and secretary, and sealed with the seal of the board. If an applicant fails to pass said examination his or her fee shall be returned.

All papers received by the secretary in relation to applications for license shall be kept on file in his office, and a proper index and record thereof shall be kept by him.

SEC. 5. **Architects Who are Entitled to License Without an Examination.**— Any person who shall, by affidavit, show to the satisfaction of the State Board of Examiners of Architects that he or she was engaged in the practice of the profession of architecture on the date of the passage of this act, shall be entitled to a license without an examination, provided such application shall be made within six months after the passage of this act. Such license, when granted, shall set forth the fact that the person to whom the same was issued was practicing architecture in this State at the time of the passage of this act, and is, therefore, entitled to a license to practice architecture without an examination by the Board of Examiners, and the secretary of the board shall, upon the payment to him of a fee of twenty-five dollars ($25), issue to the person named in said affidavit a license to practice architecture in this State, in accordance with the provisions of this act. In the case of a copartnership of architects, each member whose name appears must be licensed to practice architecture. No stock company or corporation shall be licensed to practice architecture, but the same may employ licensed architects. Each licensed architect shall have his or her license recorded in the office of the county clerk in each and every county in this State, in which the holder thereof shall practice, and he or she shall pay to the clerk the same fee that is charged for the recording of notarial commissions. A failure to have his or her license so recorded shall be deemed sufficient cause for revocation of such license.

SEC. 6. **County Clerks to Keep Record of Licenses Recorded.**— Each county clerk shall keep in a book, provided for the purpose, a complete list of all the licenses recorded by him under the provisions of this act, together with the date of the issuance of each license.

SEC. 7. **Licensed Architects to Have a Seal.**— Every licensed architect shall have a seal, the impression of which must contain the name of the architect, his or her place of business, and the words, "Licensed Architect," "State of Illinois," with which he shall stamp all drawings and specifications issued from his office for use in this State.

SEC. 8. **Penalty for Practicing Architecture Without a License.**— After six months from the passage of this act it shall be unlawful, and it shall be a misdemeanor punishable by a fine of not less than fifty dollars ($50) nor more than five hundred dollars ($500) for each and every week during which said offense shall continue, for any person to practice architecture without a license in this State, or to advertise, or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect.

SEC. 9. **Persons Who Are to be Regarded as Architects.**— Any person who shall be engaged in the planning or supervision of the erection, enlargement or alteration of buildings for others, and to be constructed by other persons than himself, shall be regarded as an architect within the provisions of this act, and shall be held to comply with the same; but nothing contained in this act shall prevent the draftsmen, students, clerks of works or superintendents, and other employes of those lawfully practicing as architects, under license as herein provided for, from acting under the instruction, control or supervision of their employers; or shall prevent the employment of superintendents of buildings paid by the owners from acting, if under the control and direction of a licensed architect who has prepared the drawing and specifications for the building. The term building in this act shall be understood to be a structure, consisting of foundations, walls and roof, with or without the other parts; but nothing con-

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tained in this act shall be construed to prevent any person, mechanic or builder from making plans and specifications for, or supervising the erection, enlargement or alteration of any building that is to be constructed by himself or employes, nor shall a civil engineer be considered as an architect unless he plans, designs or supervises the erection of buildings, in which case he shall be subject to all the provisions of this act, and be considered as an architect.

SEC. 10. **License Revoked.**— Architect's licenses issued in accordance with the provisions of this act shall remain in full force until revoked for cause, as hereinafter provided. Any license so granted may be revoked by unanimous vote of the State Board of Examiners of Architects for gross incompetency, or recklessness in the construction of buildings, or for dishonest practices on the part of the holder thereof, but before any license shall be revoked such holder shall be entitled to at least twenty days' notice of the charge against him, and of the time and place of the meeting of the board for the hearing and determining of such charge. And on the cancellation of such license it shall be the duty of the secretary of the board to give notice of such cancellation to the county clerk of each county in the State in which the license has been recorded, whereupon the clerks of the counties shall mark the license recorded in his office canceled. After the expiration of six months from the revocation of a license, the person whose license was revoked may have a new license issued to him by the secretary upon certificate of the Board of Examiners, issued by them upon satisfactory evidence of proper reasons for his reinstatement, and, upon payment to the secretary of the fee of five dollars ($5).

For the purpose of carrying out the provisions of this act relating to the revocation of licenses, the board shall have the power of a court of record, sitting in the county in which their meeting shall be held, and the power to issue subpœnas and compel the attendance and testimony of witnesses. Witnesses shall be entitled to the same fees as witnesses in a court of record, to be paid in like manner. The accused shall be entitled to the subpœna of the board for his witnesses, and to be heard in person or by counsel in open public trial.

SEC. 11. **Renewal of License.**— Every licensed architect in this State who desires to continue the practice of his or her profession shall annually, during the time he or she shall continue in such practice, pay to the secretary of the board during the month of July a fee of five dollars ($5), and the secretary shall thereupon issue to such licensed architect a certificate of renewal of his or her license for a term of one year. Any licensed architect who shall fail to have his or her license renewed during the month of July in each and every year shall have his or her license revoked at the discretion of the board. But the failure to renew said license shall not deprive him or her of the right to renewal upon payment of said fee.

SEC. 12. **Report of Proceedings to be Filed with the Auditor of Public Accounts.**— Within the first week of December, after the organization of the board, and annually thereafter, the secretary of the board shall file with the Auditor of the State a full report of the proceedings of the board, and a complete statement of the receipts and expenditures of the board, attested by the affidavits of the president and secretary, subject to the approval of the State Auditor.

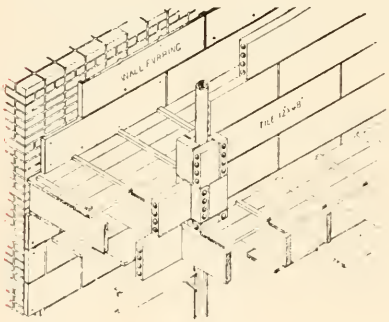
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Peter B. Wight

Secretary of the State Board of Examiners of Architects.

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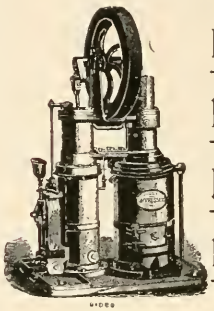
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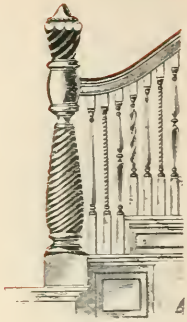
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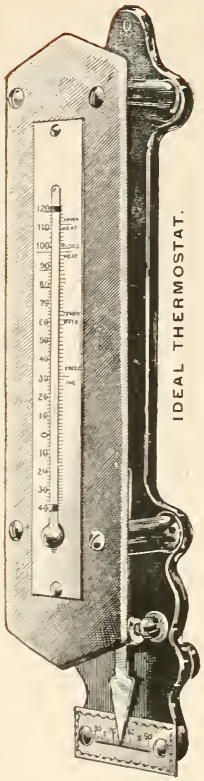
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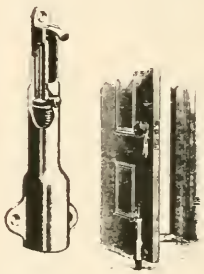
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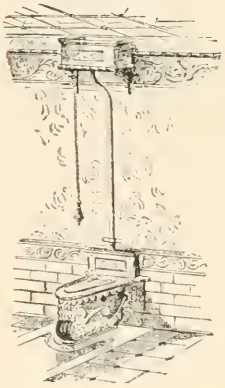
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Stiles, Clarence L 148 Hartford Building.
Schock, F. R 172 Washington street.
Schlacks, H. J 1503 Schiller Building.
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Schmid, R. G Metropolitan Block.
Stanhope, L. E 725 Unity Building.
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Smith, Robert S 187 Dearborn street.
Schoenfeldt, Frank 1747 West Twelfth street.
Schroeder, John M 6442 Langley avenue.
Schulze, William 1608 Milwaukee avenue.
Strandel, Charles A 82 La Salle street.

Thomas, Charles W 310 Chamber of Commerce Building.
Torrence, James R Roanoke Building.
Treat, S. A 1507 Fisher Building.
Turnock, E. Hill 110 Randolph street.
Thain, J. A 3152 Prairie avenue.
Thomas, William 163 Randolph street.

Ullrich, R. C 301 Roscoe boulevard.

Vail, Morrison H 1439 Unity Building.
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RULES FOR THE MEASUREMENT OF MASONRY.

(From Official Directory of Builders' and Traders' Exchange, of Chicago, 1897-98.)

INTRODUCTION.

The following rules are the expression of a custom founded in equity and prevailing in this city from its earliest days:

If to furnish and lay one thousand brick in a plain dead wall cost $10, another piece of brickwork of equal cost must be measured as of the same contents, even though it does not take one-fourth as many brick.

The plain dead wall, in stone as well as brick work, is taken as the standard, and the more difficult, complicated, ornamental and hazardous kinds of work are measured up to it, so as to make the compensation equal. To illustrate: If in one day a man can lay two thousand brick in a plain dead wall, and can lay only five hundred in a pier or arch in the same time, the cost of labor per thousand in such work is four times as much as in a wall, and he is entitled to extra compensation; but instead of varying the price, the custom varies the measurement to compensate for the difference, and thus endeavors to secure a uniform price per thousand for all descriptions of ordinary brickwork, instead of a different price for the execution of the various kinds of work.

This is the principle underlying the system.

If any new rules or new applications of old rules should be found in the following, we can only say in their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

The units of measurement of mason's work are:

For Excavation, the cubic yard.
" Concrete, foundations, the cubic foot.
" Concrete, floors, the superficial foot.
" Dimension stone, footings, the superficial yard.
" Dimension stone, bridge masonry, the cubic foot.
" Dimension stone, surface dressing, the superficial foot extra.
" Rubblework, the cubic foot.
" Rubblework, surface dressing, the superficial foot extra.
" Brickwork, common, the thousand brick.
" Brickwork, pressed, the superficial foot.
" Tuckpointing, cleaning fronts, the superficial foot.
" Plastering, plain surfaces, the superficial yard.
" Plastering, cornices, the running and superficial foot.

EXCAVATION

to be measured and computed by the actual amount of material displaced — no allowance for rehandling.

CONCRETE.

FLOORS.

Foundations — Measure actual contents.

Floors to be measured by the superficial foot of surface between walls.

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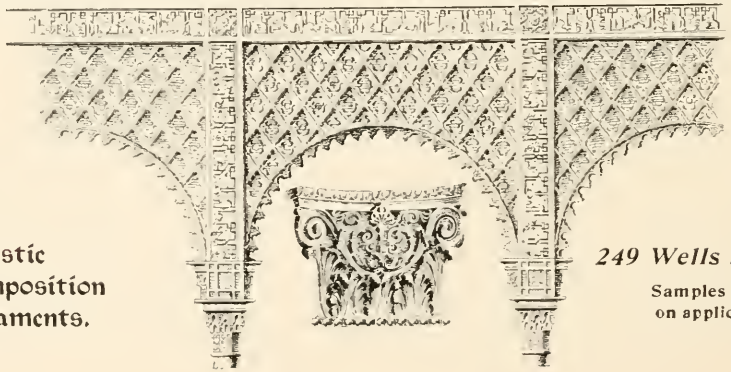
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No deduction for tile drains, nor for any pier, chimney breast, plaster or other projection of walls of ten feet or less in area.

DIMENSION STONE.

FOOTINGS.

Footings to be measured each course separately — no deductions for drain or other openings under walls two feet or less in width.

Bridge Masonry — Compute actual cubic contents.

Surface dressing of all kinds, extra.

RUBBLE WORK.

Footings to be measured by actual cubic contents.

NOTE.— Footings are all such foundation courses, not exceeding sixteen inches in height each, as are wider than the body of the above.

NOTE.— In the following the term Corner is used for salient angles of walls, and Angle for re-entering angles.

EXTERNAL WALLS.

Girt building and add thickness of wall for each external angle.

PARTITION WALLS.

Intersection of partition walls two feet or less in width to be measured double; if wider, add four cubic feet to actual contents of every intersection for each foot in height.

BEVELED CORNERS.

For each corner of wall more or less than ninety degrees, add one foot six inches to length of wall.

CIRCULAR WALLS.

For round walls add one-fifth of length of girt measure.

PILASTERS, ETC.

All projections, such as chimney breasts, piers connected with walls, and pilasters, to be measured actual cubic contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

PIERS.

Independent square piers to be measured by the same rule.

Polygon and round pier work at special rates.

RECESSES, ETC.

Recesses and slots to be measured solid, and in addition thereto allow one cubic foot for every foot in height.

ARCHES.

Stone arches are classed as cut-stone work.

OPENINGS.

Deduct contents of windows, doors and other openings, measuring from top of sill to spring of arch, and add two feet of wall for each jamb for every foot in height of opening.

No deductions are to be made for cut-stone trimmings and lintels.



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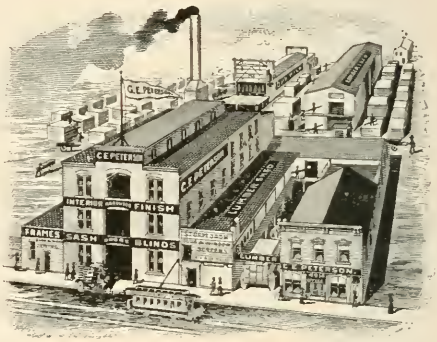
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NOTE.— Different cities make different bricks ; in reality the products of no two brickyards are entirely alike in size, nor, for that matter, all brick burned in the same kiln. The necessity of acknowledging some standard for purposes of mensuration and calculation is obvious. In these rules the dimensions of a brick are understood to be 2 by 4 by 8 inches. We therefore speak of 4-inch walls, meaning the width of one brick ; of 8 inch, meaning the width of two bricks, and of 12 inch walls, meaning the length of one and width of another brick, etc., although the actual width of wall will be more or less in excess of these measures.

Every superficial foot of "one-half brick (or 4-inch) wall" to be estimated at seven and one-half bricks ; of "one brick (or 8-inch) wall" at fifteen bricks ; of "one and one-half brick (or 12-inch) wall" at twenty-two and one-half bricks ; of "two brick (or 16-inch) wall" at thirty bricks, etc.— increase the number of brick by seven and one-half for every additional half-brick in thickness of wall.

EXTERNAL WALLS.

If sixteen inches thick or less, girt building and add thickness of wall for each external angle.

When thicker, add to actual contents of each corner one and one-half cubic feet for every foot in height.

Allow for wall ends as for corners.

ROUND WALLS.

Sixteen inches thick or less.

For circular walls, of radius sufficiently large to obviate the necessity of using specially molded or cut brick, add one-fifth of length to girt.

When thicker, allow for sixteen inches of such wall as per above rule, and measure all in excess as straight work.

Cut or molded work at special rates.

BEVELED CORNERS.

For each corner of wall of more or less than ninety degrees, add one foot six inches to length of girt.

PARTITION WALLS.

Sixteen inches thick or less. Intersections of partition walls (bonded together in any manner — not abutting) to be measured double.

When thicker, add one and one-half cubic feet to actual contents of every intersection for each foot in height.

Partition walls connecting with stone walls to be measured one foot into such wall.

CHIMNEY BREASTS AND PILASTERS.

All flues and hollows in chimneys four feet or less in area to be measured solid.

When larger, deduct one-half contents of flue.

For all chimney breasts and pilasters add eight inches to face for each corner and multiply length so obtained by width (projection).

Detached chimneys in buildings and plain chimney tops to be measured solid and one-half of one cubic foot to be added for each corner for every foot in height.

STACKS.

Chimney stacks at special rates.

When square, find cubic contents, measuring hollow walls solid, and deducting flue.

When round or octagon, take length of diameter for side, and measure as though it was square.



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PIERS.

Independent piers to be measured like chimneys.

HOLLOW WALLS.

Hollow walls to be measured solid.

STONE FRONTS.

Stone fronts backed with brickwork. Deduct thickness of ashlar from width and figure like ordinary walls.

GABLES AND WALL TOPS.

Whenever clipping of brick is required, add to actual contents the length of line of clipping by one foot by thickness of wall.

CORNICES AND BELTS.

If of running courses only, multiply length by height (greatest girt in the cut) by greatest projection.

If enriched (by corbels, brackets and panels), multiply other dimensions, as given, by greatest girt length.

LEDGES.

Multiply length by height by greatest projection.

PROJECTIONS.

All other projections, if of four inches or less, to be measured four inches; if above four inches, and not exceeding eight inches, to be measured eight inches; if above eight inches, and not exceeding twelve inches, to be measured twelve inches, etc.

GAUGE WORK.

Gauged work at special rates.

OPENINGS.

Openings to be measured from top of sill to spring of arch and shortest distance between brick jambs for width.

No deductions to be made for openings two feet six inches or less in width.

One-half of contents to be deducted of openings from two feet six inches to six feet in width.

For openings of more than six feet in width allow one foot six inches by thickness of wall by height for each jamb.

SLOTS, PANELS, ETC.

No deduction to be made for slots, chases, niches, panels or other recesses of four feet or less in width; if wider, deduct contents, and add two cubic feet of wall for every foot in height.

TRIMMINGS.

No deductions in measuring brickwork for cut-stone or other trimmings, bond-blocks, timber, joists or lintels.

ARCHES.

Arches—not gauged.

In vaults: multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add to wall measurement.

In sewers and tunnel arches, multiply length of extrados by thickness of arch.

BROWN BROS. MFG. CO.

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SIDEWALK LIGHTS

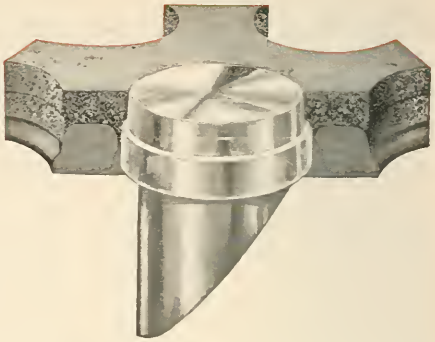
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OFFICE AND STUDIO,

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OPPOSITE LOGAN MONUMENT.

FLOOR ARCHES AND BRICK PAVING.

Floor arches and brick paving to be measured by the superficial foot and by rule given for measuring concrete. Deduct well-holes.

BRICK-NOGGING.

Measure as ordinary brickwork. Deduct full openings—no studding.

CUTTING.

Cutting of joists or other poles by the piece ; of slots, panels and recesses by the lineal foot.

TOOTHING.

When ordered by the owner or his superintendent to tooth, rack or block, in consequence of delay of iron, stone or other material, that masonwork may connect with, such toothing, racking or blocking shall be measured as extra work, as follows : Increase girt length of such line by one-half, and multiply by one foot of thickness of wall.

PRESSED BRICKWORK.

Measure all exposed surfaces of brick by the superficial foot.

CUT-STONE SETTING.

Measure vault covers, flagging, curbing and ashlar by the superficial foot, coping and belt courses by the lineal foot ; all other cut stone by the cubic foot.

TUCKPOINTING AND CLEANING.

Tuckpointing and cleaning and pointing stonework to be measured by the superficial foot of exposed surfaces.

DEAFENING.

Deafening to be measured by the superficial yard, floor measure, between walls—take out well-holes.

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OSCAR A. REUM, Sec'y. WILLIAM ZANDER, Gen. Supt.

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STANDARD RULES OF THE MEASUREMENT OF PLASTERING

ADOPTED BY THE

EMPLOYING PLASTERERS' ASSOCIATION OF CHICAGO.

LATH AND PLASTERING

to be measured by the superficial yard, from floor to ceiling for walls, and from wall to wall for ceiling.

In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents of all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, quirks, rule joints and moldings, to be measured by the lineal foot on their longest extension; add one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of two feet girt or less to be measured on walls by the lineal foot. Plain cornices exceeding two feet girt to be measured by the superficial foot. Add one lineal foot by girt for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches, by the piece. Ceiling or frieze plates over eight inches wide, by the square foot.

COLUMNS.

All columns to be measured by the lineal foot.

CEMENT WAINSCOTING.

All cement wainscot to be measured by the square foot, openings to be allowed as for plain plaster.

GROUNDS.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 2-coat lath work	¾ inch
Grounds for 3-coat lath work	⅞ inch
Grounds for 3-coat metal lath work	¾ inch
Grounds for 3-coat metal lath work, on ½-inch iron furring	1 inch
Grounds for 3-coat metal lath work, on 1-inch iron furring	1½ inch
Grounds for hard mortar lath work	⅝ inch
Grounds for hard mortar metal lath work	½ inch
Grounds for hard mortar metal lath work, on ½-inch iron furring	⅞ inch
Grounds for 2-coat work on brick or tile	½ inch
Grounds for hard mortar on brick or tile	½ inch

Where metal lath is spoken of it applies to all wire or metal lath.

"The term 'warming buildings by hot water,' though literally correct, conveys a completely wrong idea of the results. Individual ideas differ greatly in this, but where nearly all are wrong is in supposing that the source of warmth is perceivable, as is the case with other methods of heating. A house properly warmed by hot water has the atmosphere, perpetually, of a still summer evening; and in this statement there is no exaggeration whatever. A man's love of an open fire, and its cheerful blaze, is another literal truth without a correct meaning; for no one seeks, nor enjoys, the cheerfulness of a fire with the thermometer registering 68 to 72 degrees. Perhaps the greatest benefit of this method of heating is the total absence of disagreeable, and no less hurtful, draughts of cold air. There is no reason why an entrance-hall, staircase or landing should be lower in temperature than within the rooms of a residence, and this without impairing ventilation." The immensely increased use of hot-water heating apparatus, and the employment of many modern labor-saving devices in the manufacture of these goods, has greatly reduced the cost, while the apparatus itself has been rendered much more efficient, so that purely from the point of economy a modern hot-water heating apparatus is a necessity even in the smallest cottages as well as in the palatial residences. Every architect and intending builder should possess a copy of the complete catalogue of these goods furnished gratis by the American Radiator Company of Chicago, who are the largest manufacturers in the world.



Fig. 1

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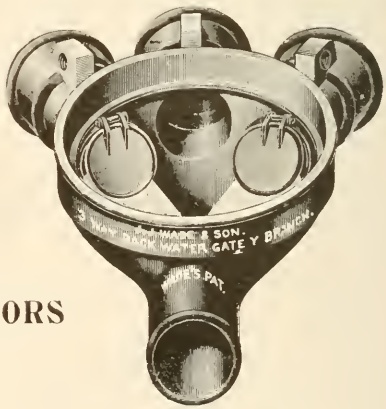


Fig. 3

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Accessible Sewer-Flushing Fittings and Back-Water Gates.

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Fig. 6

Monadnock
Building...

CHICAGO,
ILL.

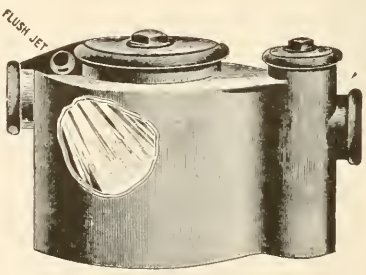


Fig. 23.

SEND FOR CATALOGUE AND PRICE LIST.

BUILDING ORDINANCE.

PASSED MARCH 28, 1898.

Be it ordained by the City Council of the City of Chicago :

SECTION 1. **Building Department Established.**—There is hereby established an executive department of the municipal government of the City of Chicago, which shall be known as the Department of Buildings, and shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, a Secretary to the Commissioner, also such Inspectors of Elevators, Inspectors of Stand Pipes and Fire Escapes, and Inspectors of Buildings, and such other assistants and employes as the City Council may, by ordinance, prescribe and establish.

SEC 2. **Commissioner — Appointment — Term — Duties.**— There is hereby created the office of Commissioner of Buildings, who shall be the head of said Department of Buildings, and shall be an experienced architect, civil engineer or builder, and who shall not be engaged in any other business while acting as Commissioner of Buildings.

He shall hold his office for the term of two years, and until his successor shall be appointed and qualified. He shall be appointed by the Mayor, by and with the advice and consent of the City Council, on the first Monday in May, 1898, or as soon thereafter as may be.

SEC. 3. **Commissioner's Bond.**—Said Commissioner, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of twenty-five thousand ($25,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

SEC. 4. **Appointment of Subordinates.— Bonds of Subordinates.**— He shall have the management and control of all matters and things pertaining to the Department of Buildings, and shall appoint, by and with the consent of the Mayor, all subordinate officers and assistants named in the first section of this ordinance, and may remove them for inefficiency or neglect of duty. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

Said Commissioner shall require good and sufficient bonds to be given by all subordinate officers and employes in said department who shall receive, or have the care, custody or handling of any money belonging to the City of Chicago, and said bonds shall be approved by the Mayor and Comptroller.

SEC. 5. **Enforcement of Ordinances.**— It shall be the duty of said Commissioner to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

SEC. 6. **Precautions in Behalf of Public Safety.— May Require Repair or Alteration in Such Cases.**—It shall be the duty of the Commissioner of Buildings, when any citizen representing that ashes or combustible materials are kept in any place in the city in an insecure manner, or that the doors or stairways in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic or accident ; or that the funnels, flues, fire boxes or heating apparatus in any building in the city are insecure or dangerous, or that any part of any building in the City of Chicago is in an unsafe or dangerous condition, or in any wise in contravention of this ordinance, to make an examination of such place or building, and if such representation is found to be true said Commissioner shall give notice in writing to the owner or lessee of such place or building to make such changes, alterations or repairs as public safety or the ordinances of the City of Chicago may require ; and it shall be unlawful to continue the use of such building until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make said building or part thereof safe or to bring it into compliance with this ordinance, shall have been made.

SEC. 7. **Inspection of all Buildings in General Use.— Must Report all Unsafe Conditions.**—The Commissioner of Buildings shall inspect or cause to be inspected all public school buildings, public halls, churches, theaters and all buildings used either for manufacturing or commercial purposes, also all hotels, apartment houses and other buildings occupied by large numbers of people, for the purpose of determining the safety of such buildings, or any parts or appliances or equipment thereof, the sufficiency of their doors, passageways, aisles and stairways, and generally their facilities for egress in case of fire or other accident ; the strength of their floors, their safeguards connected with the storage of combustibles, their appliances for extinguishing fires and for resisting the spread of fire, and shall make returns

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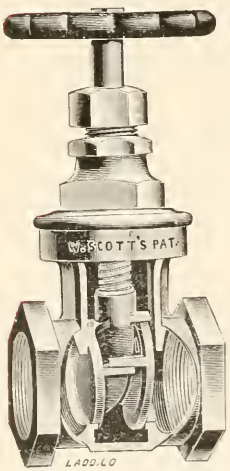
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of all violations of the several provisions of this ordinance to the Law Department for prosecution.

SEC. 8. **Must Keep Record of Private Property Taken for Public Use.—Issue of Permits for Such Property Guarded Against.**— Hereafter, upon the passage of an ordinance providing for the taking of any private property for public use, the Commissioner of Public Works shall, at once, cause a plat of the property proposed to be taken to be made and file the same in the office of the Commissioner of Buildings. The Commissioner of Buildings is hereby instructed not to issue any permit for the erection or improvement of any building or buildings in or upon any of the property proposed to be taken by any ordinance as aforesaid, until such ordinance shall have been repealed.

SEC. 9. **Interpretation of This Ordinance.**—The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this ordinance relating to the manner of construction, subject to the conditions, modifications and limitations contained in this ordinance.

SEC. 10. **Inspection of Elevators—Power to Stop Use of Same.**—The Commissioner of Buildings shall have power to prohibit and stop the use of any passenger or freight elevator when the Inspector of Elevators shall report to him that the elevator or the hoistway in which it is used is in a dangerous or unsafe condition. And such prohibition of use shall continue in force until such hoistway or elevator, or both, shall have been put in safe condition, and certified to be safe after a proper inspection thereof by the Inspector of Elevators.

SEC. 11. **May Order Precautions Taken in Unsafe Buildings.—May Direct Fire Department to Remove.**—The Commissioner of Buildings shall have authority, if he finds any building or part thereof in such condition as to endanger life, and so that such danger may be averted by the immediate application of precautionary measures, to cause such precautionary measures to be taken, and all work necessary to render said building or any part thereof safe to be done, after having served written notice upon the owner, lessee, occupant or agent of said building personally.

The Commissioner of Buildings shall also have authority to direct the Fire Department, after written notice has been served upon the owner, lessee, occupant or agent personally, to tear down any defective or dangerous wall, or any building, or any part thereof, which may be constructed in violation of the terms of this ordinance. And in case of the destruction, or partial destruction, of buildings by fire, or by the action of the elements, when any department of the City Government, pursuant to the ordinances of the city and the duty of the city in the premises, shall make any outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of any such building or buildings, or for the preservation of the life or health of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or his or their agent or agents, and it shall be the duty of the said Commissioner of Buildings to refuse to issue a permit for the reconstruction, alteration or repair of any such building or buildings by such owner or owners, or his or their grantees, until such outlay or expenditure shall be repaid to the city by the owner or owners of said building or buildings (or his or their grantees), so totally or partially destroyed in the manner aforesaid.

SEC. 12. **May Make Rules for Construction of Buildings.**—The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations as shall secure the careful erection and inspection of all buildings while in process of construction, alteration, repair or removal, and the strict enforcement of the several provisions of this ordinance.

SEC. 13. **May Stop Construction When in Violation of Ordinance.—Must Sign All Certificates and Notices.**—Said Commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner, or in violation of any ordinance of said city, and to order in writing, or by parole, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building to stop and desist therefrom.

The Commissioner of Buildings shall sign all certificates and notices required to be issued from said department, and keep a record of the same, and issue all permits and collect all fees authorized herein to be collected by said department.

SEC. 14. **Must Keep a Register.**—Said Commissioner of Buildings shall keep in proper books for that purpose a register of all transactions of the Department of Buildings, which said books shall be open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council, at all times.

SEC. 15. **Must Keep Account of Fees Paid.**—Said Commissioner shall keep, in proper books for that purpose, an accurate account of all fees paid, giving the name of the party, date and amount of such fee or fees.

SEC. 16. **Must Render Report Monthly.**—The Commissioner of Buildings shall on the first day of each month render a report, under oath, to the City Comptroller of the number of building permits issued, with the amounts collected for the same, number of elevator certificates issued, with the amounts collected for the same, and with said reports shall file a duplicate receipt from the City Collector of moneys thus collected.



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SEC. 17. **Must Make Annual Report to City Council with Estimates.**— The Commissioner of Buildings shall annually, on or before the first day of February, in each year, prepare and present to the City Council a report showing the receipts and expenditures and entire work of his department during the previous fiscal year, and he shall at the same time send to the Comptroller a full and comprehensive statement of all matters pertaining to his department, together with an estimate in detail of the appropriations required by the department during the next municipal year.

SEC. 18. **Salary.**— The salary of the Commissioner of Buildings shall be $5,000 per year.

SEC. 19. **Deputy Commissioner — Qualifications — Duties.**— The Deputy Commissioner of Buildings to be designated by the Commissioner shall be a competent civil engineer, architect or builder, who has had at least ten (10) years' experience in architectural work. He shall pass upon all questions relating to the strength and stability of buildings, and act as Commissioner of Buildings in case of the absence of the Commissioner from his office, and while so acting shall discharge all the duties and possess all the powers invested in or imposed upon the Commissioner of Buildings.

SEC. 20. **Salary.**— The salary of the Deputy Commissioner of Buildings shall be $4,000 per annum.

SEC. 21. **Secretary — Duties of.**— The Commissioner of Buildings shall appoint a Secretary, whose duty it shall be to preserve and keep all books, records and papers belonging to said office, or which are required by law to be filed therein. The Secretary shall deliver to the City Council and to the respective departments all communications from said Commissioner in writing, and shall attend to the office of said department during the usual business hours, and do and perform such of the services as may be required by said Commissioner.

SEC. 22. **Inspectors — Qualifications — Examination of.**— The Inspectors of Buildings shall be competent men, either architects, civil engineers, masons, iron workers or carpenters, bricklayers or stonecutters, who have served at least five (5) years as such, not including the term of apprenticeship. They shall be men of good character, able to make out with clearness written reports, and no person shall be appointed as Inspector of Buildings who is deficient in these qualifications. Before their appointment to office they shall pass an examination as to their ability and fitness before a committee of five examiners to be appointed by the Civil Service Commission. A majority of said examiners shall sign a certificate as to the applicant's competency to perform all the duties of the office, and, if appointed, he shall not be engaged in other business or vocation but that of Inspector of Buildings.

SEC. 23. **Inspectors — Their Duties — Reports — How Made.**— The said inspectors shall, under the direction of the Commissioner of Buildings, examine all buildings in the course of erection, alteration, repair or removal throughout the city, at least once a week, or as often as required for securing efficient supervision, and shall make written reports to said Commissioner as to all violations of any ordinance or ordinances of the city which the Department of Buildings is required to enforce, together with the street and number where such violations are found, the names of the owner, agent, lessee, occupants, architect, contractors, and master mechanics, and all other matters relative thereto as far as they can ascertain them.

SEC. 24. **Must File Daily Report.**— The Inspectors of Buildings shall file daily report of their work of inspection, which shall be entered in books to be kept for this purpose, and which shall be open to official inspection at all times.

SEC. 25. **Record of Inspection — How Made.**— The said inspectors shall examine all buildings and walls reported dangerous or damaged by fire or accident, and make a record of such examinations, with the name of the street and number of the building, and of the names of the owners, agents, lessees, and occupants thereof.

SEC. 26. **Inspection of Alteration, Enlargement or Raising.**— The Inspectors of Buildings shall examine all buildings for which an application to raise, enlarge or alter has been made, and shall make a written report upon the condition of the same to the Commissioner of Buildings.

SEC. 27. **Other Duties.**— Said inspectors shall perform such other duties as may be required of them by said Commissioner of Buildings, the rules and regulations of the Department of Buildings, or the ordinances of the city.

SEC. 28. **Elevator Inspectors — Qualifications — Examinations.**— The Inspectors of Elevators shall be experienced mechanical engineers, builders or mechanics, and shall before appointment pass examination the same as the Building Inspectors, and shall not be employed or engaged in any other business or vocation,

SEC. 29. **Elevator Inspections — How Made — Record of.**— They shall as often as once in six months carefully examine and inspect each hoistway in which an elevator is used or operated, and the doors and shafts in connection therewith; and also examine and inspect all passenger and freight elevators, cars or platforms used and operated in any building in the City of Chicago, and report in writing to the Commissioner of Buildings the condition of each hoistway and elevator, and shall enter such reports in books kept for this purpose and open to official inspection.

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SEC. 30. **Inspector — Fees.** — The owners, agents or occupants of all buildings in which elevators are used shall pay the Commissioner of Buildings, before a certificate of inspection is issued to him, a fee of two ($2) dollars for each inspection of each elevator made in pursuance of this ordinance.

SEC. 31. **Certificates of Inspection — Details of.** — When an inspector finds a hoistway, door, shaft and elevator in a perfectly safe condition, he shall make and deliver to the owner, or to his or her agents, a certificate signed by the Commissioner, which shall contain the date of inspection, the condition of the elevator at that date, the weight it may safely carry, and that the shaft and doors are constructed in a safe and proper manner, or are constructed in accordance with this ordinance, which certificate shall be by the owner of the elevator framed and put up in some conspicuous place in such elevator, for examination by the public; *provided*, that the words "safe condition" in this section shall mean that it is safe for any load up to its original safe capacity.

SEC. 32. **Other Duties.** — The Inspector of Elevators shall perform such other duties as may be required of him by the Commissioner of Buildings, the rules and regulations of the Department of Buildings, or the ordinances of the city.

SEC. 33. **Entrance to Buildings.** — The Commissioner and Deputy Commissioner of Buildings, as well as the Inspectors of Buildings and of Elevators, are empowered to enter any building, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed in accordance with the terms of this ordinance, and it shall not be lawful to exclude them from such building.

SEC. 34. **Appeal from Decision — Arbitration. — Limit of Time of Appeal. — Cost of Appeal. — Arbitrators to Take Oath. — Power to Examine Witnesses. — In Urgent Cases Commissioner's Power Final. — Emergency Board of Arbitration.** — In cases where discretionary power to estimate damage to frame buildings is given the Commissioner of Buildings, as also in questions relating to the security or insecurity of buildings or parts thereof, and in all other cases where discretionary powers are, by these ordinances, given to the Commissioner of Buildings, an appeal to arbitration shall be allowed to parties believing themselves injured or wronged, by the decisions of the Commissioner of Buildings, as follows, to-wit:

The persons wishing to make such appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given them. An appeal made later than five days after serving of the notice of the Commissioner of Buildings shall not entitle the appellant to an arbitration. The request for arbitration shall be in writing, and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator. The Commissioner of Buildings shall thereupon state to the appellant the cost of such arbitration, and such appellant shall, within twenty-four hours from the time of filing the original request for arbitration, deposit with the Commissioner of Buildings the sum of money required for defraying the expenses of the same, which sum shall in each case be fixed by said Commissioner in proportion to the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city, and the two arbitrators thus appointed shall, if they cannot agree, select a third arbitrator, and these arbitrators shall, after investigating the matter in question, make a decision with regard to the same, which shall be final and binding upon the appellant as well as upon the city. The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath to the effect that they are unprejudiced as to the matter in question, and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing both to the Commissioner of Buildings and to the appellant from his decision. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report, and shall be in full of all costs incident to the arbitration; but should the decision of said Board of Arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him, and the entire costs of said arbitration shall be paid by the City of Chicago.

Whenever the Decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case so urgent that failure to promptly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

Provided, If in the opinion of the Commissioner of Buildings it becomes necessary to demolish any building, or part thereof, said Commissioner of Buildings shall call to his aid the President of the Illinois Chapter of the American Institute of Architects and the President of the Builders' and Traders' Exchange of Chicago, or their appointees, who, with the Commissioner of Buildings, shall form a Board of Arbitration, and the decision of a majority of said Board shall be absolute and final. Said Board of Arbitration shall serve without pay, and must report within forty-eight hours after their appointment; but it is expressly understood that said Board of Arbitration shall not have any authority or power in cases of walls or buildings destroyed by fire, explosion or similar causes, and that the decision of the Commissioner of Buildings in such cases shall be absolute and final.

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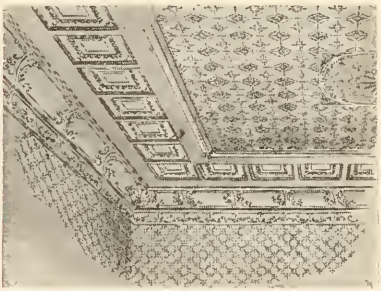
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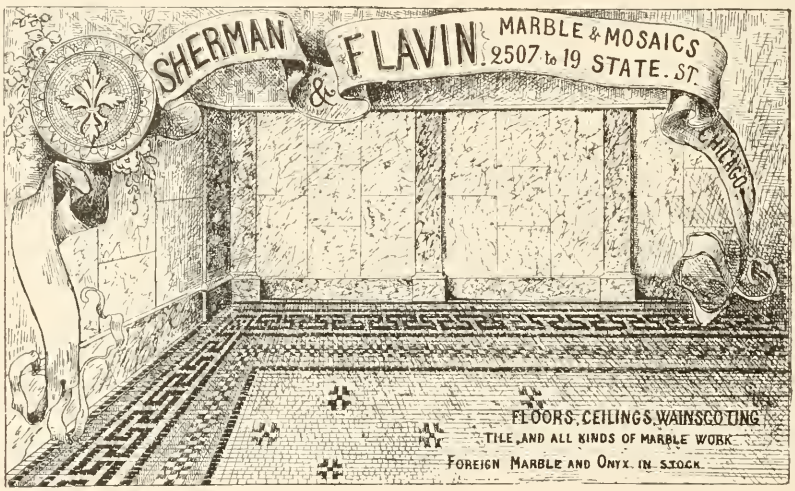
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SEC. 35. **Permits—When Required.—Limitation of Time for Permits.**—Before proceeding with the erection, enlargement, alteration, repair or removal of any building in the City of Chicago, a permit for such erection, enlargement, alteration, repair or removal shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of buildings, or of any structural part thereof, or of any structure which is to be used for the support, shelter or enclosure of persons, animals or chattels within the City of Chicago, unless such permit shall first have been obtained from the Commissioner of Buildings.

If, after a permit for the erection, enlargement, alteration, repair or removal of a building shall have been granted, the operation called for by the said permit shall not be begun within six months of the date thereof, or if such operations are not completed within the time fixed in said permit for the duration thereof, then said permit shall be void, and before such operations can be begun or completed, a new permit shall be taken out by the owner or his agent, and fees as herein fixed for the original permit shall be paid therefor.

SEC. 36. **Application for Permits—How Made—How Recorded.—Stamped Plans—How Cared For.—Return of Same.**—Applications for such permits shall be made in writing by the owner or his agent, and when such application and plans and specifications conform to this ordinance, the Commissioner of Buildings shall issue a permit, and shall file said application, and shall apply to such plans and specifications an official stamp, stating that the drawings and specifications, to which the same have been applied, comply with the terms of this ordinance. The plans and specifications so stamped shall then be returned to such applicant. True copies of so much of said plans and specifications as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to in this ordinance shall be filed with the Commissioner of Buildings, and shall remain on file in his office until the completion or occupation of said building, after which such such drawings and specifications shall be returned by the Commissioner of Buildings to the parties by whom they have been deposited with him, upon the demand of said person or persons. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than three months after the completion or occupation of any building.

And all such plans and drawings shall be drawn to a scale of not less than one-eighth ($\frac{1}{8}$) of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade nor obliterate. All distances and dimensions must be accurately figured, and drawings made explicit and complete, showing the entire sewerage and drain pipes and location of all plumbing fixtures within such building. Each set of plans presented for permit must be accompanied by a set of specifications describing all materials to be used in the proposed building, and both the plans and specifications must be approved by the Commissioner of Buildings before a permit will be granted. No permit shall be granted, or plans approved, unless such plans shall be signed and sealed by a licensed architect, as provided in "An act to provide for the licensing of architects and regulating the practice of architecture as a profession in the State of Illinois," approved June 3d, 1897. Provided, that permits may be granted for the erection of buildings of Class III, as hereinafter defined, provided such building shall not be more than two stories in height and shall have a superficial area of not more than 1,250 square feet, outside dimensions, on plans approved by the Commissioner of Buildings, which plans need not be signed by a licensed architect; provided, that all architects and applicants for such permits shall obtain from the City of Chicago a license, as provided for in Section 219 of this ordinance.

SEC. 37. **Alterations Upon Stamped Plans Not Permitted Without Permission.**—It shall be unlawful to erase, alter or modify any lines, figures or coloring contained upon such drawings or specifications so stamped by the Commissioner of Buildings, or filed with him for reference. If, during the progress of the execution of such work, it is desired to deviate in any manner effecting the construction of other essential of the building from the terms of the application, drawing or specification, notice of such intention to alter or deviate shall be given in writing to the Commissioner of Buildings, and his written assent must first be obtained before such alteration or deviation may be made. Alterations in buildings which do not involve any change in their structural parts or of their stairways, elevators, fire escapes or other means of communication or ingress or egress may be made without the permission of the Commissioner of Buildings.

SEC. 38. **Deposit with Water Department—How Made—Indemnifying Bond.**—Before the Commissioner of Buildings issues a permit as aforesaid, he shall first satisfy himself that the applicant for such permit has made payment to the Bureau of Water of the City of Chicago for the water to be used in such building, or for water meter for measuring all the water used in the construction of such building under the regulations of the Bureau of Water. He shall also, before issuing such permit, satisfy himself that the applicant for the same has filed with and approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city as against any and all damage that may arise to the streets or alleys upon which such building is situated, and to the City of Chicago, and to life and limb of passers-by, in consequence of the proposed operations to be covered by said permit.

SEC. 39. **Fees for Water Used.—Fees for Street Obstructions.**—The fees to be paid in connection with permits for the erection of buildings, shall be as follows, to-wit:

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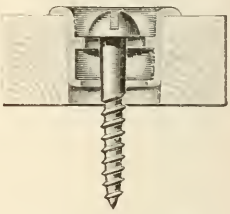
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At the rate of eight cents for every 100 cubic feet of concrete used in connection therewith; also,

At the rate of fifteen cents for every 100 yards of plastering used in connection therewith; and,

At the rate of five cents for every 100 cubic feet of hollow tile arch, partition or fireproof covering used in any building.

Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid for, in proportion to the street frontage occupied, at the rate of two dollars per month for each twenty-five feet of frontage so occupied.

Provided, That before any permit is issued by the Commissioner of Public Works to any person, firm or corporation engaged in the roofing business, for leave to use the public streets for delivery of material or as a temporary storage place for such roofing material, such person, firm or corporation shall file with the Commissioner of Public Works a bond to the City of Chicago in the sum of five thousand ($5,000) dollars, to be approved by said Commissioner of Public Works, conditioned to save the City of Chicago harmless from all damages on account of such user, and shall also deposit for each job or building, if the Commissioner of Public Works shall so require, the sum of fifty ($50) dollars with the said Commissioner of Public Works for the purpose of securing the immediate repair and clearing of any portion of the public streets encumbered by such material, and for this purpose not less than the sum of two ($2) per month in advance, during the furnishing of such roofing material, shall be charged against said deposit for the use of the City of Chicago for the purpose aforesaid of clearing the public streets of such material as may be accidentally or otherwise scattered thereon during the furnishing of such roofing material in the case of each building or appurtenance upon which roofing is being done by such person, firm or corporation, and the balance of such deposit in each instance will be surrendered to such person, firm or corporation at any time upon the surrender of the permit for the use of the public streets for the particular job in which the permit was issued and the said deposit made and the surrender of the receipt therefor.

SEC. 40. **Permits—Cost of.**—The price for building permits proper shall be as follows:

For sheds not exceeding 256 square feet in area, $1.

For open shelter sheds at the rate of fifty cents for each 1,000 cubic feet or part thereof.

For buildings one story in height and not exceeding 25 by 40 feet in area, $1.50.

For buildings more than one story in height or larger in area than 25 by 40 feet, the fee for the permit shall be at the rate of ten cents for every 1,000 cubic feet or fractional part thereof contained in said structure, the cubic contents being measured to include every part of the building from the basement floor to the highest point of roof, and all bay windows and other projections.

SEC. 41. **Occupation of Sidewalk and Street—Limitations.**—The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the premises of the building upon which said permit is issued.

During the progress of building operations, at least one-third of the sidewalk in front of the premises of the building for which such permit is granted, shall be at all times kept free and unobstructed for the purposes of passage, and clear of rubbish, dirt and snow. Such sidewalks must, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as such excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

SEC. 42. **Delivery of Material—Elevated Sidewalks.—Temporary Roof Over Sidewalk—Time Maintained.—Storage of Building Materials—Limitations.—Excavated Material and Rubbish—How Cared For.**—It shall be permitted, for the purpose of delivering material to the basements of the buildings, to elevate such temporary sidewalks to a height of not exceeding four feet above the curb level of the street; and in case a sidewalk is so elevated, it shall be provided with good substantial steps on both ends of the same, and shall have railings, as before specified, on both sides thereof.

If the building to be erected is more than four stories in height, and is set at or near the street line, there shall be built over such sidewalk a roof having a framework and covering, composed of supports and stringers of 3 by 12 timbers, not more than four feet from centers, covered by two layers of 2-inch plank.

Said roof shall be maintained as long as material is being used or handled on said street front and above the level of such sidewalk.

In all cases, such temporary sidewalks and their railings and approaches, and the roofs over the same, shall be made, as regards ease of approach, strength and safety, to the satisfaction of the Commissioner of Buildings.

The occupation of the street for the storage of building materials shall never exceed, in front of any one building, one-quarter of the width of the roadway of the same, and in streets

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containing railroad tracks, such occupation shall not exceed one-half the distance from the curb stone to such railroad track.

Earth taken from excavations, and rubbish taken from buildings, must not be stored either upon sidewalk or roadways of streets, and must be removed from day to day as rapidly as produced. When dry rubbish, apt to produce dust, is being handled, it must be kept wetted down, so as to prevent its being blown about by the wind.

SEC. 43. **Derricks — Limitations.**—For all buildings more than four stories in height, the use of derricks set upon the sidewalk is prohibited. Materials for such buildings shall be hoisted entirely within the enclosing walls of the same. On no condition shall derrick posts be allowed put on the public street, and in no case shall the guy lines be less than 15 feet above the roadbed.

SEC. 44. **Adjacent Frontage — How Occupied for Building Purposes.**—It is provided that if the written consent and a waiver of claims for damages against the City of Chicago of the owners of properties abutting upon the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building sites themselves.

SEC. 45. **Use of Street for Building Purposes — When Terminated.**—The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and must terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

SEC. 46. **Red Lights.**— Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

SEC. 47. **Hospitals — Stables — Special Consents Necessary.**— Before granting permits for the construction or alteration or enlargement of hospitals or of livery, sale or boarding stables, the Commissioner of Buildings shall take notes of the following provisions of this ordinance relating to such buildings:

SEC. 48. **Hospitals — Permits — Special Consents.**— It shall be unlawful to erect, establish, build, construct or maintain any hospital for the treatment and nursing of any person or persons, affected with any disease whatever, on any residence street or avenue in the City of Chicago, until there be first obtained the written consent of the person or persons who may be the owners or agents of the entire frontage of the four sides of the block in which such building is to be located, and the entire frontage of the block on the opposite side of the street on which such building faces. Such written consent, as is herein provided, shall be filed with the Commissioner of Buildings before any permit shall be granted for the construction or erection of any building for such hospital.

SEC. 49. **Stable Permits — Special Consents.**— It shall not be lawful for any person to locate, build, construct or keep on any street in any block in which one-third of the buildings are devoted to exclusive residence purposes, a livery, boarding or sale stable, gas house, gas reservoir or other building for any business purpose, unless the written consent of the property owners or agents on both sides of the street in such block shall be first obtained and filed with the Commissioner of Buildings before a permit be granted for the construction or keeping of such buildings.

SEC. 50. **Permits for Raising or Altering Buildings — Requirements.**— Permits to alter or raise wooden buildings shall be given, provided they do not involve an enlargement or raising of such buildings beyond the limits of dimensions herein prescribed for frame buildings, and if the strains upon material thereof are kept within the maximum strains herein fixed for the same; and if, further, said frame building has not been damaged to any extent greater than 50 per cent of its original value by fire, wear and tear, the action of the elements or otherwise.

SEC. 51. **Permits for Moving Buildings — Requirements.— Written Consents Must be Obtained.— Affidavit Made.**— Permits to move buildings shall be granted in accordance with the following: If said frame building has not been damaged to an extent greater than 50 per cent of its original value by fire, wear and tear, the action of the elements or otherwise. Any person desiring to remove a wooden building shall first obtain the written assent to such removal from persons owning a majority of feet front of lots in the same block in which it is proposed to locate such removed building, and also a majority of persons owning front feet opposite the proposed location and within 150 feet of the same. And such person shall also file an affidavit subscribed and sworn to by one or more persons in the following form, as near as may be, viz:

CITY OF CHICAGO, }
COUNTY OF COOK, STATE OF ILLINOIS, } ss.

And.....each being duly sworn on oath, deposes and says, each for himself, that he was present and saw the persons whose names are subscribed to the above petition, sign the same,

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and that each and every one of said parties claimed at the time of said signature that they were the owners of the property placed opposite their respective names in the above petition, or the attorneys or agents of the owners, with full authority to sign and act for them. Subscribed and sworn to before me this.....day of....., A. D. 18....

This section shall not apply to the case of any person removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

SEC. 52. **House Mover's License and Bond.—Fee for House Moving—Requirements.**—No person, except a licensed house mover, shall remove any building within the limits of the city; and every such person shall annually, before engaging in said occupation, obtain a license therefor from the Commissioner of Public Works, and no such license shall be granted until the party applying therefor shall have given a bond in the sum of $5,000, with good and sufficient sureties, to be approved by the Commissioner of Public Works, conditional, among other things, that said party will pay any and all damages which may happen to any pavement, street or sidewalk, or to any telegraph pole or wire belonging to the City of Chicago, or to any tree or trees, whether said damage or injury shall be inflicted by said party or his agents, employes or workmen; and conditional, also, that said party will save and indemnify and keep harmless the City of Chicago against all liabilities, judgments, costs and expenses, which may in any wise accrue against said city in consequence of the granting of such permit or license, and will in all things strictly comply with the conditions of his permit.

Upon the execution of said bond and its acceptance of said Commissioner of Public Works, a license shall be issued, and the said licensed person shall in each and every instance, before removing any building, obtain a permit to do so from the Commissioner of Public Works, and shall pay to said Commissioner a fee of $5, whereupon said Commissioner shall issue a permit, stating specifically all the conditions, describing the route to be taken, and limiting the time for removal.

The fee for a permit to remove a building from one part of a lot to another part of the same lot, or from one lot to another, when the same is owned by the same persons, and where said building or buildings are to be removed without crossing any street or alley, or the property of any person or persons, other than the owner of the lot from which the building is to be removed, shall be $1.

SEC. 53. **Violation of Building Ordinance—Revocation of Permit—Requirements for Reissue.**—If work upon any building shall be conducted in violation of any of the provisions of this ordinance, either as to occupation of sidewalk or street, or the use or application of material or workmanship, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building operations in connection with which such violation shall have taken place. And it shall be unlawful, after the revocation of such permit, to proceed with such building operations, unless such permit shall first have been reinstated or reissued by the Commissioner of Buildings. Before a permit, revoked for the cause or causes before mentioned, can be lawfully reissued or reinstated, the entire building and building site must be first put into condition corresponding with the terms of this ordinance, and any work or material applied to the same in violation of the terms of this ordinance shall be first removed from said building.

SEC. 54. **Fire Limits.**—The fire limits of the City of Chicago shall be as designated in Section 214 of this ordinance. The provisions of this ordinance as to the strength and stability of timber constructions shall also apply to the construction of frame buildings outside of the fire limits.

SEC. 55. **Frame Buildings Outside Fire Limits.**—Outside of said fire limits it shall be lawful to erect frame buildings not exceeding forty (40) feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of brick their height above the sidewalk may be made 45 feet.

SEC. 56. **Raising Frame Buildings—Requirements.—Changing Hip Roofs to Flat Roofs.**—Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roofs.

SEC. 57. **Repairing Damaged Buildings—Limitations.**—It shall not be lawful to repair or reconstruct or remove any frame building which has been injured more than 50 per cent of its original value by wear and tear, by the effects of the elements, or by fire, nor to occupy for human habitation any building which is declared by the Commissioner of Health to be unfit for such habitation by reason of defective sanitary conditions, until such conditions have been remedied and the premises approved by said Commissioner of Health as fit for occupancy.

SEC. 58. **Frame Buildings—Requirements as to Lot Lines—Number—Dimensions.**—Frame buildings shall not be built nearer than one foot to any line of the lot upon which

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they are built, street and alley lines excepted. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them.

SEC. 59. **Chimneys in Frame Buildings.—Chimney Flues Through Partitions.**— Chimneys in frame buildings shall be built of brick, or if built of hollow tile there shall be a double tile wall around the smoke duct; they shall have socket joints. All joints, whether in tile or in brick chimneys, shall be well filled with mortar and neatly pointed on the outside. Brick chimneys to have flue linings of fire clay on the inside. The wood framing of frame buildings shall be trimmed around chimneys in such manner as not to come within two inches of the same.

Metal smoke pipes or tile flues of single thickness shall not extend through the floors or through the ceiling or roof of any building; and where such smoke pipes or tile flues pass through partitions the woodwork of such partitions shall be protected either by a course of brick built all around such smoke pipes or tile flues, or by a thimble made of bright tin, the two rings thereof being at least three inches apart, with proper ventilating holes provided in the outer covering of the same on both sides of the partitions.

SEC. 60. **Frame Buildings Carried to Uniform Height.**— Frame buildings, the different parts of which are of different heights, may be carried up to a uniform height, provided the aggregate height thereof does not exceed the limits of height prescribed for frame buildings.

SEC. 61. **Basement Placed Beneath Frame Building.**— A frame building may be raised, for the purpose of erecting a basement story under the same, but the principal floor of such frame building shall not be raised to a higher level than six feet above the sidewalk grade for two-story buildings, or twelve feet high above the sidewalk grade for one-story frame buildings. The walls enclosing such basement shall be of masonry, and if the frame building is one story high, such walls shall not be less than eight inches thick, or if such frame building is two stories high, the basement walls shall not be less than twelve inches thick. The foundations of such walls are to be constructed as elsewhere herein stated under the head of foundations. It is provided, however, that no frame building shall be raised, for the purpose of constructing a basement under the same, to a greater height to the top of its roof, than that elsewhere herein given as the maximum height above grade for frame buildings. It is also provided that after there has been a basement story constructed under any frame building, such frame building shall not be raised again for any purpose whatsoever.

SEC. 62. **Buildings Inside Fire Limits.**— Within the fire limits of the City of Chicago, all buildings hereafter constructed, altered or enlarged, shall comply with the following:

SEC. 63. **Wooden Sheds — Requirements.**— Sheds not exceeding fourteen (14) feet in height from the ground at the highest part thereof, and not exceeding 256 feet in area, with an incombustible roof, may be constructed of wood; such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling, or an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of 25 feet.

SEC. 64. **Open Shelter Sheds — Height of Walls and Foundations.— Coal Sheds — Height — To be of Fireproof Material.**— Open shelter sheds may be constructed, provided they have incombustible roofing not over 15 feet high from the ground to the highest point of roof, and the roof supported on sufficient posts or piers. Such sheds shall have no enclosing walls or wooden floors. No fence shall be used for the back or side of such shed. If it is intended to enclose an open shelter shed the enclosing walls must be made of brick or of hollow tile. Such enclosing walls must have foundations extending to solid ground, and at least four feet below the surface of the ground. Provided, that coal sheds erected upon docks or navigable waters within said city, may be constructed not over thirty-five (35) feet high from the ground to the highest point of the roof, and when such shed shall be enclosed the enclosing walls shall be made of fireproof material.

SEC. 65. **Storage and Manufacture — Stables.— Hotels and Boarding Houses.— Residences.—Assembly Halls.— Class of Building not to be Changed without Conforming to Ordinance.**— As a means of reference in this ordinance, buildings erected within the fire limits (sheds and shelter sheds as before described being excepted) shall be divided into classes as follows:

Class I.— In this class shall be included all buildings devoted to the sale, storage or manufacture of merchandise, and all stables over 500 square feet area.

Class II.— This class shall embrace all buildings used as residences for three or more families, all hotels, all boarding or lodging houses occupied by twenty-five or more persons, and all office buildings.

Class III.— This class shall embrace all buildings used as residences for one or two families, or for less than twenty-five persons, and stables under 500 square feet area.

Classes IV and V.— These shall include all buildings used as assembly halls for large gatherings of people, whether for purposes of worship, instruction or entertainment.

If buildings, the uses of which bring them within any of the before mentioned classes, are to be applied to the uses of any other class for which a better system of construction is called for by this ordinance, the construction and equipment of such buildings must first be made to conform to the requirements of this ordinance as specified for their intended use.

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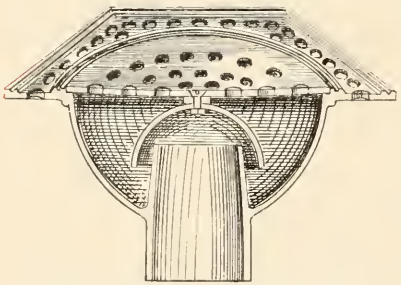
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And it shall be unlawful to apply such building to a new or different use than that to which its structure and equipment adapts it under this ordinance, unless the requirements of this ordinance for such new or different use shall first have been complied with, and a permit for such alteration of use shall have been first obtained from the Commissioner of Buildings.

SEC. 66. **Definition of Terms — Fireproof Construction.— Materials for Fireproofing.— Window Mullions.**— In describing the construction of the buildings belonging to the various classes before enumerated, the following definitions of terms shall apply throughout this ordinance:

The term "Fireproof Construction" shall apply to all buildings in which all parts that carry weights or resist strains, and also all stairs and all elevator enclosures and their contents, are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which must be entirely incombustible and a slow heat conductor. The materials which shall be considered as fulfilling the conditions of fireproof covering are: First, brick; second, hollow tiles of burnt clay, applied to the metal in a bed of mortar, and constructed in such a manner that there shall be two air spaces of at least three-fourths of an inch each by the width of the metal surface to be covered, within the said clay covering; third, porous terra cotta, which shall be at least two inches thick, and shall also be applied direct to the metal in a bed of mortar.

In buildings of this type all door or window mullions, whether vertical or horizontal, shall be faced with cast iron, terra cotta or other incombustible material of equal fire-resisting values.

SEC. 67. **Skeleton Construction.— Where Cast-Iron Pillars Are Used—Requirements.—Fireproof Construction Where Walls Do Not Carry Floors or Roof.**—The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and strains are transmitted from the top of the building to the foundations by a skeleton or framework of metal. In such metal framework the beams and girders shall be riveted to each other at their respective junction points. If pillars made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders resting upon them shall have riveted or bolted connections to unite them with the pillars. If cast-iron pillars are used, each successive pillar shall be bolted to the one below it by at least four bolts, not less than three-fourths inch in diameter, and the beams and girders shall be bolted to the pillars. At each line of floor or roof beams, lateral connection between the ends of the beams and girders shall be made by passing wrought-iron or steel straps across or through the cast-iron column, in such manner as to rigidly connect the beams and girders with each other in the direction of their length. These straps shall be made of wrought iron or steel, and shall be riveted or bolted to the flanges or to the webs of the beams and girders.

If buildings are made fireproof entirely, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall be not less than twelve inches in thickness; and provided, also, that such walls shall be thoroughly anchored to the iron skeleton; and provided, also, that wherever the weight of such walls rests upon beams or pillars, such beams or pillars must be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All partitions must be of incombustible material.

SEC. 68. **Slow-burning Construction Defined.—Fireproof Covering of Posts and Elevator Enclosures.**—The term "Slow-burning Construction" shall apply to all buildings in which the structural members which carry the loads and strains which come upon the floors and roof thereof are made wholly or in part of combustible material, but throughout which the combustible as well as the incombustible materials shall be protected against injury from fire, by coverings of incombustible, non-heat-conducting material similar to those described under the head of "skeleton construction," except that a single covering of plastering on metal lath and metal furring shall be considered sufficient protection for the underside of joists, and that a deafening of mortar or its equivalent applied at least one and one-half inches thick shall be used to cover all floors and roof surfaces above the joists of the same. Where oak posts of greater sectional area than one hundred square inches are used, they need not have special fireproof covering. All partitions and all elevator enclosures in buildings of this type shall be made entirely of incombustible material. The use of wood furring or of stud partitions shall not be allowed in buildings of this class.

SEC. 69. **Mill Construction Defined.—Fireproofing.**—The term "Mill Construction" shall apply to all buildings in which all the girders and joists supporting floors and roof have a sectional area of not less than seventy-two square inches, and above the joists of which there is laid a solid timber floor of thickness not less than three and three-fourths inches thick. Wooden posts used in buildings of this class shall not be of smaller sectional area than one hundred square inches. Partitions and elevator enclosures in buildings of this class shall be made entirely of incombustible material. If iron pillars, girders or beams are used in buildings of this class, they shall be protected as provided for fireproof buildings; but the wooden posts, girders and joists need not be protected by fireproof covering. The use of wood furring, wood laths or stud partitions shall not be permitted in buildings of this class.

SEC. 70. **Ordinary Construction Defined.**—By the term "Ordinary Construction," as used in this ordinance, is meant the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings.

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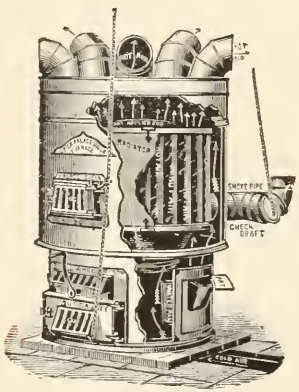
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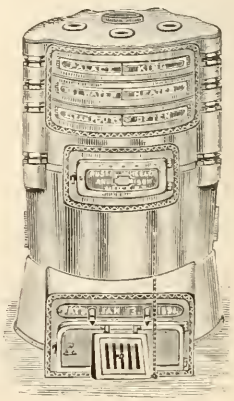
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SEC. 71. **Materials.**—Materials used in the construction of buildings of all classes shall conform to the following specifications:

SEC. 72. **Foundation Proportions.—Foundations—How Constructed.**—Foundations shall be proportioned to the actual average loads they will have to carry in the completed and occupied building, and not to theoretical or occasional loads.

Foundations shall be constructed of either of the following: Cement concrete, dimension or rubble stones, sewer or paving bricks. If iron or steel is used, filling and coating of same shall be of Portland cement; timber piles covered with grillage of oak timber or concrete. It being provided that where oak grillage is used the top of such grillage must be at least one (1) foot below city datum; wherever sewer in adjoining streets or alleys are below city datum then the top of such oak grillage must be at least one (1) foot below the bottom of such sewers.

SEC. 73. **Pile Foundations—Borings Required—Safe Load Required—Fiber Strain.**—Where pile foundations are used, borings of the soil shall first be made to determine the position of the underlying stratum of hard clay or rock, and the piles shall be made long enough to sustain the required load according to approved formulas for pile driving, and such piles shall not be loaded more than 25 tons to each pile. The heads of the piles are to be protected against splitting while they are being driven, and after having been driven the piles are to be sawed off to uniform level and covered with an oak timber grillage, so proportioned that in the transmission of strains from pile to pile the extreme fiber strain in the timbers composing the grillage shall not be more than twelve hundred pounds to the square inch.

SEC. 74. **Foundations Other than Pile.**—If foundations of other materials than piles are used, they shall be so proportioned that the loads upon the soil shall not exceed the limits for different kinds of soil than those hereafter given, to-wit:

SEC. 75. **Load for Clay Fifteen Feet Thick.**—If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance excepting gravel, it shall not be loaded more than at the rate of 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

SEC. 76. **Load for Sand Fifteen Feet Thick.**—If the soil is a layer of dry sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it shall not be loaded more than at the rate of 4,000 pounds per square foot.

SEC. 77. **Load for Mixed Soil.**—If the soil is a mixture of clay and sand, it shall not be loaded more than at the rate of 3,000 pounds per square foot.

SEC. 78. **Foundations in Wet Soil—Trenches to Be Drained.**—In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless the trenches in which the work is being executed are kept free from water by bailing, pumping or otherwise, until after the completion of work upon the foundations.

SEC. 79. **Foundation—Where Not Permitted.**—Foundation shall not be laid on filled or made ground, or on loam, or on any soil containing admixture of organic matter.

SEC. 80. **Depth Below Surface—Least Limit.—Depth Regulated by Sewer—Exceptions.—Sewer Connections to be First Laid.—Foundation of Brick Wall Upon Wooden Sills.—Level of Sills Allowed.**—Foundations must in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings forty feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the neighboring streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations; excepting and providing that buildings not exceeding one story in height and eighteen feet in height from top of sills to highest point of roof, and side walls not exceeding twelve feet in height, and floor area not exceeding 1,200 feet in superficial area, may have brick walls not less than eight inches in thickness, erected on wooden sills, the sills supported on vertical posts, or piers, sunk four feet below the surface of the ground. The foundations under such posts or piers shall be of wood or stone, each covering not less than five square feet area to support the weight that may rest upon them with safety; sills to be placed not higher than one foot above the established grade on the street fronting the lot upon which the building is erected, where grades are established, and not exceeding six feet above the ground where grades are not established, the sills and space from sills to the ground to be protected with fireproof material.

SEC. 81. **Broken Stone—Sand.—Cement.—Concrete—Mortar—Foundations of.**—Broken stone for concrete in making foundations must be clean and free from dirt and dust. All sand must be free from admixture of loam, and must be otherwise clean and sharp.

Cement must have been kept dry, and must be used fresh from the package; cement which has been permitted to become wet, hard or lumpy before it is mixed into the mortar or concrete, shall not be used.

The use of concrete or mortar of all kinds, the ingredients of which are not thoroughly and completely mixed, and which are not free from lumps or other unmixed portions of any of the ingredients, is prohibited; and also the use of cement mortar which has become partly or wholly set before use. Concrete foundations wherever used must have boxes of plank all

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around them, and the concrete must be well rammed in individual layers not more than six inches each in thickness. The ramming must be continued until the water stands on the top of the mass of concrete.

SEC. 82. **Steel Rails or Beams in Concrete.**— If steel or iron rails or beams are used as parts of foundations, they must be thoroughly imbedded in a concrete, the ingredients of which must be such that after proper ramming, the interior of the mass will be free from cavities. The beams or rails must be entirely enveloped in concrete, and around the exposed external surfaces of such concrete foundations there must be a coating of a standard cement mortar not less than one inch thick.

SEC. 83. **Concrete Foundations — Steps — Safe Load Where Reinforced by Beams.**— If concrete foundations are used by themselves and without the insertion of iron or steel beams or rails, the offsets on top of same shall not be more than one-half the height of the respective courses, and such concrete foundations must not be loaded more than 8,000 pounds per square foot. If reinforced by iron or steel beams or rails, the loads and offsets in the same must be so adjusted that the fiber strain upon the metal, if iron, shall not exceed 12,000 pounds per square inch, or, if steel, that the fiber strain shall not exceed 16,000 pounds per square inch.

SEC. 84. **Dimension Stone.— Safe Load.**— Dimension stones must have uniform beds, and the offsets in the same, where two or more layers are used, must not be more than three-quarters of the height of the individual stones. They must be set with full beds of cement mortar under their entire area, and in such manner that they will not rock after being set. Dimension stone in foundations shall not be subjected to a load of more than 10,000 pounds per square foot in piers.

If the beds of the stones are dressed and leveled off to uniform surface and the stones are set in a standard cement mortar, this strain may be increased to 14,000 pounds per square foot.

SEC. 85. **Rubble Stone.**— Rubble foundations and rubble walls must be built of approximately square and flat-bedded stones, well and thoroughly bonded in both directions of the walls, each stone thoroughly bedded in mortar under its entire area. Wherever walls of any kind are used as curb walls, their exterior surfaces must be rendered approximately water-tight by a coating of a standard cement mortar.

SEC. 86. **Use of Soft Brick — Bond — Safe Load.**— The use of soft bricks is prohibited in all parts of buildings exposed to the weather and in internal or external piers. The bond of brickwork shall be formed by laying one course of headers for every five courses of stretchers. Brickwork in walls laid in a standard Portland cement mortar shall not be loaded more than 25,000 pounds per square foot. Brickwork laid in an ordinary cement mortar shall not be loaded more than 18,000 pounds per square foot. Brickwork in walls laid in lime mortar shall not be loaded more than 13,000 pounds per square foot.

SEC. 87. **Walls — Ledges.**— Whenever walls sixteen inches or less in thickness shall be used for the support of ordinary joists in buildings of Classes I, IV and V, ledges four inches wide shall be formed for the support of such joists. Wherever in buildings of Class II joists rest upon walls twelve inches or less in thickness, ledges four inches wide shall be formed for the support of such joists. Wherever in buildings of Class III joists rest upon enclosing or upon party walls eight inches thick there shall be ledges projecting two (2) inches from such walls, and the joists shall not extend into the main walls more than two (2) inches. In buildings of all classes where furring strips, whether combustible or incombustible, are used on brick walls, there shall be ledges equal to the thickness of such furring strip upon such walls, and in all cases where ledges are built, they are to be carried up to and leveled off on the line of the tops of the joists.

SEC. 88. **Pressed Brick Facing — Bond Joints.**— If pressed brick facing are used, they must be bonded into their backing every seventh course. Bond shall be established by solid headers, or by blind headers, or by means of metallic anchors. In the case of piers faced with pressed brick, only solid headers shall be used, but bond stones or iron bond plates may be substituted for such headers. Pressed brick in all cases must be so laid as to have full bearing of mortar under its entire surface. The laying of pressed brick merely with a joint all around the outer edge of the bricks shall be unlawful.

SEC. 89. **Brick Piers — Offsets — Bond Stone — Cap Stone.**— In building brick piers, there shall be provided at every offset in each pier, or at every point where such brick pier receives the load, a bond stone at least eight inches thick, and at the top of each pier a cap-stone at least ten inches thick, or in all such cases a bond plate of cast or rolled iron, which stones or plates if at the top of such piers shall cover the entire surface of such pier, and shall in all cases be adapted to receiving the load to be imposed and shall be made of a strength which will keep the fiber strain upon the material used within the limits elsewhere herein stated.

SEC. 90. **Arches for Support of Floors.**— Hollow tile and porous terra cotta may be used in the form of flat arches for the support of floors and roofs; such floor arches having a height of at least two inches for each foot of span. The arches must be so constructed that the joints of the same point to a common center; the butts of the arches shall be carefully

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fitted to the beams supporting them; and there shall be a cross rib for every six inches or fractional part thereof in height; and in addition to these there shall also be diagonal ribs in the butts. Floor arches made in the form of a segment of a circle or ellipse must be constructed upon the same principle. Such arches, whether flat or curved, shall have their beds well filled with mortar, and the centers shall not be struck until the mortar has been set.

Where hollow tile blocks are used for building partitions or as enclosing walls, the joints shall be well filled with mortar.

SEC. 91. **Stone Facing Without Bond Courses.—Stone Facing With Bond Courses.**—Stone may be used as facing for brick walls under the following conditions: If the facing is ashler, without bond courses, and the individual courses thereof measure in height between bond stones more than six times the thickness of the ashler, then each piece of ashler facing shall be united to the brickwork with iron anchors at least two to each piece and reaching at least eight inches over the brick wall, and hooked into the stone facing as well as the brick backing. Wherever ashler as before described is used, it shall not be counted as forming part of the bearing surface of the wall, and the brick backing shall be of the thickness of wall herein specified for the different kinds of building.

If stone facing is used with bond courses at a distance apart of not more than four times the thickness of the ashler, and where the width of bearing of the bond courses upon the backing of such ashler is at least twice the thickness of the ashler, and in no case less than eight inches, then such ashler facing shall be counted as forming part of the wall, and the total thickness of wall and facing shall not be required to be more than herein specified for walls of the different classes of buildings.

SEC. 92. **Stresses — Cast Iron Fiber — Strains — Length.— Stresses in Pounds per Square Inch.**—The stresses in materials hereafter used in construction, produced by the calculated strains due to their own weight and applied loads, shall in no case exceed the following:

CAST IRON.

Extreme fiber strains tension 2,500 lbs.
For columns 10,000 lbs.

Reduced by Gordon's formula. Reduced for eccentric load.

No cast-iron column shall have a length to exceed twenty times its diameter, or least side.

STRESSES IN POUNDS PER SQUARE INCH.

	Wrought Iron.	Steel.
Extreme fiber stresses, I beams and shapes	12,000	16,000
Extreme fiber stresses, built beams	10,000	15,000
Tension	12,000	15,000
Shearing	7,500	10,000
Direct bearing pins and rivets	15,000	20,000
Bending on pins	18,000	22,500
*For columns and compression members	12,000	15,000

*Reduced for ratio of length of column to its last radius of gyration by approved modern formulæ. Reduced for eccentric load.

Sec. 93. **Timber — Stresses in Pounds per Square Inch.— Posts.— Stresses per Square Inch.**—

TIMBER — STRESSES IN POUNDS PER SQUARE INCH

	On Extreme Fiber.	Shearing Along Grain.	Compression Perpendicular to Grain.
White pine and spruce	750	80	150
White oak	1,000	150	250
Long-leaved yellow pine	1,250	100	250

POSTS WITH FLAT ENDS.

L. Length of post in inches.
D. Least side or diameter of post in inches.
S. Stress per square inch.

White Pine and Spruce.			L. L. Yellow Pine.			White Oak.
L. D.	S.		L. D.	S.		S.
0–10	625		0–15	1,000		750
10–35	500		15–30	875		650
35–45	375		30–40	750		560
45–50	250	...	40–45	625		400
.....	...		45–50	500		375

SEC. 94. **Fireproofing Defined.— Protection of Steel.— Support of Fireproofing for Same.**—Fireproofing of the steel and iron structural parts of buildings shall, for the purposes of this ordinance, be defined as follows:

All iron or steel used as a supporting member of the external construction of any building exceeding 90 feet in height, shall be protected as against the effect of external changes of

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temperature and of fire, by a covering of brick, terra cotta or fire clay tile, completely enveloping said structural members of iron and steel. If of brick, it shall not be less than 8 inches thick. If of hollow tile, it shall not be less than 8 inches thick, and there shall be at least two sets of air spaces between the iron and steel members and the outside of the hollow tile covering. In all cases, the brick or hollow tile shall be bedded in mortar close up to the iron or steel members, and all joints shall be made full and solid.

Wherever stone facing is used, it shall be an additional thickness to the column covering above specified.

Where skeleton construction is used for the whole or part of a building, these enveloping materials shall be independently supported on the skeleton frame for each individual story.

SEC. 95. **Iron or Steel Plates for Support of Fireproofing.**— If iron or steel plates are used in each story for the support of this covering within the said story, such plates must be of sufficient strength to carry within the limits of fiber strain for iron and steel elsewhere specified in this ordinance, the enveloping material for the said story, and such plates may extend to within two inches of the exterior of said covering.

SEC. 96. **Backing for Terra Cotta.**— If terra cotta is used as part of such fireproof enclosure, it shall be backed up with brick or hollow tile; whichever is used, being, however, of such dimensions and laid up in such manner that the backing will be built into the cavities of the terra cotta in such manner as to secure perfect bond between the terra cotta facing and its backing.

SEC. 97. **Horizontal Filling—Thickness.**— The horizontal filling between the iron and steel vertical members of skeleton constructions shall be of brick or terra cotta, and in no case of less thickness than 12 inches, subject to the same conditions as to bond and courses as specified for the enveloping material of structural members, and these horizontal fillings shall be bonded into the enclosures of the vertical members.

SEC. 98. **Top Covering.**— The upper surfaces of all breaks or offsets in external coverings and fillings and walls, as well as the tops of walls, shall be covered with stone, terra cotta or fire clay copings set in cement mortar, and having lapped joints pointed with cement.

SEC. 99. **Internal Covering.**— The internal structural parts of buildings of the skeleton construction shall be fireproofed by coverings of brick, hollow tile, or porous terra cotta.

SEC. 100. **Covering of Interior Columns.**— In the case of buildings of Class I, the coverings of interior columns shall be, if of brick, not less than 8 inches thick; if of hollow tile, these coverings shall be in two consecutive layers, each not less than 2½ inches thick. If the fireproof covering is made of porous terra cotta, it shall consist of at least two layers not less than two inches thick each. Whether hollow tile or porous terra cotta is used, the two consecutive layers shall be so applied that neither the vertical nor the horizontal joints in the same shall be opposite each other, and each course shall be so anchored and bonded within itself as to form an independent and stable structure.

In all cases there shall be on the outside of the tile a covering of plastering with any standard cement mortar or of other mortar of equal hardness and efficiency when set.

In all places where plastering is used in connection with fireproof construction, asbestos plastering or a material equally as good shall be used.

SEC. 101. **Protective Covering for Fireproofing.**— In places where there is trucking or wheeling or other handling of packages of any kind, the lower five feet of the fireproofing of such pillars shall be encased in a protective covering either of sheet iron or oak plank, which covering shall be kept continually in good repair.

SEC. 102. **Metallic Lath Fireproofing.**— In buildings of "slow burning" construction, if plastering on metallic lath be used as fireproofing for columns, it shall be in two layers. The metallic lath shall in each case be fastened to metallic furrings, and the plastering upon the same shall be made with cement. Protection for the lower five feet shall be required in this case the same as where porous terra cotta or hollow tile covering is used. In all places where plastering is used in connection with fireproof construction, asbestos plastering or a material equally as good shall be used.

SEC. 103. **Fireproof Coverings for Internal Columns in Class II.**— In buildings belonging to Class II, the fireproof covering for internal columns is to be made the same as specified for the buildings of Classes I, IV and V, excepting only that but one covering of hollow tile or porous terra cotta, and but two layers of any covering made of plastering on metallic lath, are to be used.

In all places where plastering is used in connection with fireproof construction, asbestos plastering or material equally as good shall be used.

SEC. 104. **Covering of Iron or Steel Beams, Classes I, IV and V.**— The fireproof covering of iron or steel beams and girders in buildings of Classes I, IV and V, shall be effected with either of the materials before specified. If hollow tiles are used, the tiles shall be set close to the metal to be protected, and there shall be two air spaces within the tile of at least ¾ of an inch each. If plastering on metal lath is used, the furring shall be also metal. There shall be two thicknesses of such plastering on metallic laths.

In all places where plastering is used in connection with fireproof construction, asbestos plastering, or a material equally as good, shall be used.

SEC. 105. **Air Space.**— For buildings of Class II only one air space will be required in the fire protection covering.

SEC. 106. **Limitation in Changing Class of Building.**— If buildings of Class II are partly used for the purposes of Classes I, IV and V, the method of fireproofing the structural iron or steel in the whole of any story, any part of which is so used, and in the whole of the story above and below the same, shall be as called for in buildings of Classes I, IV and V.

SEC. 107. **Coverings of Beams.**— In all cases, the covering of beams, if of hollow tile or porous terra cotta, shall be so applied as to be supported entirely by the beams or girders protected, and shall be held in place entirely by the support of the flanges of such beams or girders, and by the mortar used in setting. Wire binding and anchors shall not be used as fastenings of such fireproof covering.

SEC. 108. **Arches as Filling Between Floor Beams.**— The filling between the individual iron or steel beams supporting the floors of fireproof buildings, shall be made of brick arches or concrete arches or hollow tile arches. Brick arches shall not be less than 4 inches thick, and shall have a raise of at least ¾ inches to each foot of span between the beams. If the span of such arches is more than 6 feet, the thickness of the same shall not be less than 8 inches. If hollow tile arches having a straight soffit are used, the thickness of such arches shall not be less than at the rate of 2 inches per each foot of span. If concrete arches are used, the concrete in the same shall not be strained more than 100 pounds per square inch, if the concrete is made of crushed stone, nor more than 50 pounds per square inch if the concrete is made of cinders. In all cases, no matter what the material or form of the arches used, the protection of the bottom flanges of the beams, and so much of the web of the same as is not covered by the arches shall be made as before specified for the covering of beams and girders.

SEC. 109. **Walls — Thickness of.**— The thickness of walls hereinafter specified and set forth in the tables for the various classes of buildings, shall be, for each class of buildings, intended to apply to all external enclosing walls, and also to such internal walls as may be required under the specifications of the different classes of building for the support of floors and roofs.

SEC. 110. **Bay Windows and Light Shafts—Material For.**—Bay or oriel windows and light shafts may be built of combustible material only in the following cases: In buildings of Classes I, II and III, of four (4) stories or less in height, provided such bay and oriel windows or light shafts shall not have a greater width than twelve (12) feet at wall line of building, and that no such bay or oriel window or light shaft shall be more than three stories in height above the first or main story of such buildings, and provided that the outside walls, roofs and soffits of such bay or oriel windows and light shafts, when so constructed, shall be covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts shall be constructed entirely of incombustible material, and all supports thereof shall be so proportioned that the limit of stress on such supports shall not exceed those hereinbefore scheduled.

SEC. 111. **Limitations of.**—The limitations of bay and oriel windows projecting over the street line of one building and the number and position of any such bay or oriel windows on any building, shall be as follows:

First—No such bay or oriel window shall be at a less distance than twelve (12) feet from the sidewalk grade.

Second—No such bay or oriel window shall project more than three feet over a street line of any building.

Third—No such bay or oriel window shall have a greater street frontage than fifteen feet.

Fourth—There shall not be more than one bay or oriel window for any twenty feet of frontage, and no two bay or oriel windows shall be built nearer to each other than five feet. Nothing herein contained shall, however, limit the number and size of bay and oriel windows which are built in such a manner as not to project over the street line of the building of which they form a part; provided, such bay or oriel windows shall be built entirely of incombustible material.

SEC. 112. **Construction of Buildings.—Height of Buildings.**—Buildings of Classes I, II and III, which are 100 feet or more in height, shall be made entirely of fireproof construction.

Buildings of Classes I, II and III, less than 100 feet and more than 60 feet in height, shall be built entirely of slow-burning or mill construction.

Buildings of Classes I, II and III, less than 60 feet in height, may be built of ordinary construction.

The limits of heights of buildings, hereinbefore given for non-fireproof buildings, shall be from the sidewalk level to the highest point of roof thereof.

No building shall be erected in the City of Chicago of greater height than 130 feet from the sidewalk level to the highest point of external bearing walls.

SEC. 113. **Wind Pressure—Precautions Against.**—In the case of all buildings, the height of which is more than one and one-half times their least horizontal dimension, allowances shall be made for wind pressure which shall not be figured at less than 30 pounds for

each square foot of exposed surface. In buildings of skeleton construction the metal frame must be designed to resist this wind pressure.

SEC. 114. **Basement—Meaning of.**—Wherever in this ordinance the word "basement" story is used, it is intended to mean that the floor of such story is at a distance of two feet or more below the level of the sidewalk, and that its height does not exceed eleven feet in the clear. If the floor of such story is nearer than two feet to the sidewalk grade, or if its height in the clear is more than eleven feet, it shall be counted as the first story of the building in which it occurs.

SEC. 115. **Enclosures Upon Roofs.—Parapets and Balustrades Upon Roofs.**—It shall be permitted to erect on the roofs of all buildings skylights, enclosures for water tanks and enclosures for elevator machinery, the construction of all of which enclosures shall be, if sixty feet or more above the sidewalk level, entirely of incombustible material.

The erection of parapet walls or of balustrades constructed entirely of incombustible material is permitted above the roof level of buildings of all classes, and in addition to the heights herein fixed for the same.

SEC. 116. **Fire Walls—When Dispensed With.**—Fire walls of brick not less than twelve inches thick shall be built extending above the roofs of all buildings if such roofs are flat, and also above the roofs of all buildings where the same abut against another building, or where the same stand upon any line of any lot, excepting street or alley lines. Provided, that where 8-inch walls are permitted in the top story of buildings, the fire walls shall be of the same thickness. Such fire walls, where they stand upon lot lines or where they are over the dividing walls between buildings, or over the dividing walls in the interiors of buildings, where such are called for by this ordinance by reason of the great area of such building, shall extend at least three feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines if the tops of the roof boards and roof joists are protected as against fire for a distance of at least five feet from such street or alley lines by a coating of deafening mortar on hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and material of the roof shall be made strictly fireproof.

Walls facing upon courts and light shafts shall be treated in the same category with walls facing upon streets and alleys.

Fire walls must be covered with a weatherproof coping of incombustible material.

SEC. 117. **Incombustible Window and Door Sills.**—Window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this ordinance, be counted incombustible, but no other form or use of wood construction shall be considered incombustible.

SEC. 118. **Pillars and Lintels Supporting Store Fronts.**—The pillars and lintels supporting store fronts shall not be made of wood in buildings more than twenty-five feet above the sidewalk grade.

SEC. 119. **Shingle Roof.—Gravel Roof.—Construction of Roofs.—Pitch of Roofs.—Rise of Roof Above Limit of Height.**—The use of shingle roofs or of other forms of combustible roof covering upon buildings erected or altered within the fire limits is prohibited.

Roofs whose slope is not more than three inches per foot horizontal, and the covering of which is made with a composition of felt and gravel, shall be considered incombustible under the provisions of this ordinance, and may be used upon buildings of all classes.

In the case of all buildings less than sixty feet in height, roofs having a slope of more than that specified for composition roofs may be made of timber and board construction, and shall be covered with slate or glazed tile or metal. The roofs upon buildings sixty or more feet and less than ninety feet high, and of greater slope than three inches to the foot, and less slope than thirty degrees with the horizon, shall, if made of timber construction, have a fireproof covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards, and which shall be at least two inches thick. If this covering is made upon the roof boards, wooden strips shall be inserted and securely fastened to the wooden substructure at regular intervals between the fireproof covering and a weatherproof covering of sheet metal, slate or glazed tile shall be securely fastened thereto.

In the case of buildings which are entirely fireproof in their construction and of which the roof is also entirely of fireproof construction, the roof may rise above the limit of height of wall fixed by this ordinance for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding ten feet above limitation of height of such wall. The space enclosed by such roof above the legal limitation of the height of such wall may be used as an enclosure for pipes, ventilating or elevator machinery, or for ventilating ducts, but it shall not be lawful to use said attic space for purposes of storage, business or residence.

SEC. 120. **Pipes Carrying Water from Roof.**—The water from all roofs shall be carried to the street sewers in metal conductor pipes, which must be continually maintained in such condition that leaks therein will not cause the water to soak into the walls or any other part of any building.

SEC. 121. **Cornices — Gutters — Eaves — Parapets — Bay Windows.** — Where sheet metal cornices or external sheet metal gutters are used, their entire framework and covering

shall be of metal, and the walls shall extend behind all such cornices or gutters along their entire height. All metal work in and about any cornice, gutter, eave or parapet, or in or about any bay, or oriel window, shall be supported by suitable brackets placed not more than four feet apart and firmly secured to the wall. Wood shall not be used as the support of any gutter or cornice for buildings of one hundred feet or more in height.

SEC. 122. **Towers, Domes and Spires — Construction of.** — Towers, domes and spires may be built on top of the roofs of buildings of Classes I, II and III, but shall not occupy more than one-fourth of the street frontage of any building, and none shall in any case have a base area of more than 1,600 square feet. And such towers, domes or spires, if any part thereof is built to a height of more than sixty feet and less than ninety feet, shall be of slow-burning construction, and if of greater height than ninety feet above the sidewalk shall be of fireproof construction; and in all cases where the area of such spire, dome or tower exceeds one hundred square feet, its supports shall be carried down to the ground, and shall be, if the construction supported is more than sixty feet and less than ninety feet high, of slow-burning construction, and if more than ninety feet high, of fireproof construction.

SEC. 123. **Skylights — Construction of. — Glass in.** — Any skylight on the roof of any buildings of Classes I and IV and Class II over two stories in height, shall have the sides, sashes and frames constructed of metal; or of wood metalclad on all exterior surfaces.

The glass in all skylights shall have, at least six inches over same, a strong wire netting (wire not lighter than No. 8 and mesh not coarser than 1½ inch by 1½ inch), unless the glass contains a wire netting within itself.

SEC. 124. **Projection of Cornices — Belt Courses — Balconies. — Verandas — Porticos Balconies — Construction of.** — No cornice, belt course or balcony shall project more than three feet over the street line of any building, nor be less than twelve feet above sidewalk grade, and no cornice, balcony, string course, portico or veranda, if projecting over the street line of any building, shall be built in its entirety of other than incombustible material. It shall, however, be permitted to build verandas, porticos and balconies upon buildings less than sixty feet in height of combustible material, provided that no part thereof projects over the street line of the buildings of which they form part.

If verandas or porticos are to be enclosed the filling or enclosing walls must be made of incombustible material, the only exception being in case such porticos or verandas are to be made part of a storm house or of a storm door enclosure, which, however, shall in no case be more than twelve feet high, nor shall it occupy a greater frontage than two feet more than the width of the inner doors for which the storm doors are made. Permits for the erection of such storm houses or storm door enclosures may be issued subject to the provision that the same shall be maintained only from the first of November to the first of May following, and that the storm house or storm door enclosure, for which such permit is issued, shall not be used for the display of merchandise or any other thing whatsoever, but shall be used only for protection from severe and inclement weather. Such storm houses or storm door enclosures shall not extend more than three feet beyond the building line of the building in front of which the same shall be erected. The fee for each permit for storm house or storm door enclosure shall be two ($2) dollars.

SEC. 125. **Sidewalks — Occupation of by Parts of Buildings.** — The use of any part of the sidewalks for steps or for open areas is prohibited, but porticos or other entrance features, if not more than thirty feet in height, may be made to project upon the sidewalk thirty inches, but no more. Provided, that where sidewalk space is less than fourteen feet, no projection shall be permitted, and provided that such projection shall only be as an architectural feature and shall in no case be used as a show window, vestibule or for business purposes.

The foregoing prohibition for the use of sidewalk space for steps or areas shall not apply to existing buildings, but if material alteration in or additions to existing buildings are to be made, then such steps and open areas shall be made to conform to the provisions of this ordinance.

SEC. 126. **Space Beneath Sidewalks.** — In all cases where the space under sidewalks is connected with the basement of any building, the covering of the same and all the supports of such covering shall be made entirely of incombustible material, and the occupant of such space under any sidewalk shall be considered and treated as the tenant at will of the City of Chicago.

SEC. 127. **Height Above Roof. — Interior Chimneys — Walls of. — Flues — Height Above Roof. — Flues — Linings of. — Interior Chimneys — Framing Around.** — No chimney shall be built with less than four (4) inches thick brick walls, and no chimney having a greater flue area than 260 square inches shall have walls less than eight (8) inches thick; provided that in all cases where chimneys are built with walls less than eight inches thick the same shall have flue liners of fire clay or terra cotta in their entire length.

All chimneys having an area of not more than 260 square inches or less, shall be carried up to at least five feet above the highest part of roof of the building of which it is a part, if such roof is a flat roof. If the roof is a pitched roof, the chimney shall be carried up at least two feet above same.

Chimneys having a greater flue area than 600 square inches shall have surrounding walls of at least sixteen inches of brickwork, and such walls shall be built hollow with at least four inches hollow space in such walls. At a height of fifty feet above smoke inlet the thickness

of the surrounding brickwork can be reduced to twelve inches, but in all cases the surrounding walls of chimneys of this or any other size shall be so proportioned that the brickwork in same will not be subject to a greater stress than elsewhere herein fixed as the maximum safe stress for brickwork. For chimneys having a greater flue area than 1,600 square inches the thickness of walls shall be increased above the thickness above specified, four inches for each increase of 1,000 square inches or fractional part thereof.

All flues having a greater area than 250 square inches and not more than 600 square inches, shall be carried up at least twelve feet above highest point of roof of building of which they form part; and all flues having a greater area than 600 square inches and not more than 900 square inches, shall be carried up at least twenty feet above highest point of roof. All chimneys having a greater area than 900 square inches shall be carried to a height of at least twelve feet above any roof within a radius of sixty feet; provided, that the top of such chimney shall not be less than twenty feet above the roof of the building of which it forms a part.

All flues having a greater area than 400 square inches shall be lined on the inside with fire brick laid in fire clay, which lining shall start at least two feet below the smoke inlet, and for flues having an area of from 400 to 600 square inches shall extend at least twelve feet above smoke inlet, and for all flues of more than 500 square inches and not more than 1,600 square inches, shall extend twenty feet above smoke inlet, and for all flues having a greater area than 1,600 square inches shall extend at least thirty feet above smoke inlet. If an internal smoke pipe of cast-iron or steel is used, so much of the brickwork as is inside of the insulating cavity of the stack may be omitted. Wrought-iron or steel smoke stacks shall, however, be lined with fire brick for at least thirty feet of their height.

No joists or girders shall rest and be supported on the walls of any chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than eight inches, where flue liners are used, and twelve inches where flue liners are omitted.

The foregoing applies only to chimneys which are enclosed by, or form part of, the interior of any building.

SEC. 128. **External Chimneys—Location of.—Walls of Abutting Building.—Built of Iron or Steel.—Isolated Chimneys.—Foundation of Smoke Stacks.**—Chimneys may be built outside of the walls of existing buildings (but not in such manner as to encroach upon any street or alley) and shall be built as follows:

If at least one side of such chimney abuts entirely upon the wall of an existing building, and the chimney is throughout its entire length securely and firmly anchored to the walls of said existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast-iron base, lined with fire brick, and extending to a height of at least ten feet above the street or alley grade.

Such external chimney may also be built of rolled steel or iron of not less than one-fourth inch thick and lined with fire bricks, laid in fire clay, for at least forty feet above street or alley grade, or it may be built throughout its entire height of cast iron, in which case the first ten feet above street or alley grade shall be lined with fire brick, laid in fire clay.

If isolated chimneys are built, they shall also have hollow walls, and shall be so designed and constructed that the stress upon any part thereof, due from the weight of the stack itself and from wind pressure, shall never exceed the limits elsewhere in this ordinance fixed as the maximum stress for brick masonry.

The foundations of smoke stacks, whether inside or outside of buildings, or whether connected with the same or isolated, shall be designed and built in conformity with the provisions relating to foundations of buildings hereinbefore given.

SEC. 129.—**Metallic Chimneys Passing Through Floors and Roofs.**—Metallic chimneys or smoke pipes shall not be used inside of any building in such manner as to pass through the floors or roofs of the same, unless such metallic smoke pipes or chimneys are enclosed in brick or tile walls, with an air-space between the enclosing walls and the smoke pipe from bottom to top.

SEC. 130.—**Smoke Pipes Passing Through Partitions.—Smoke Flues—Woodwork Around.**—Where smoke pipes of diameter twelve inches or less pass through a wood or a plastered stud partition, they shall be surrounded either by a body of brick, hollow tile, porous terra cotta or other substance, measuring at least eight inches all around such smoke pipe.

Smoke flues of less diameter than twelve inches shall be kept at least twelve inches distant from any woodwork, and such woodwork immediately over and for a distance of two feet on each side of such smoke pipe must be covered with sheet metal or with porous terra cotta or hollow tile or with plaster.

Smoke pipes of greater diameter than twelve inches and less area than six square feet, must be kept at least twenty inches away from any woodwork, and such woodwork must be protected as before specified for the smaller smoke pipes to a distance of four feet on each side of such smoke pipe.

Wherever smoke pipes of larger area than six square feet are used they shall be kept at least three feet distant from any woodwork, and such woodwork for a distance of at least six feet on either side of said smoke pipe shall be protected as before specified for smaller pipes.

SEC. 131. **Floors, Protection of—Around Boilers, Furnaces, Etc.—Ceiling, Protection of—Around Boilers, Furnaces, Etc.**—Wherever steam boilers or furnaces or ovens, coffee roasters or other structures in which fires are maintained, are set inside of a building or in a room with wooden floor or ceiling construction, the floor of the same shall be protected by a covering of brick or concrete not less than five inches thick set in mortar upon a continuous sheet-metal bearing plate not less than $\frac{3}{16}$ of an inch thick, all the joints of which are to be securely riveted and the edges of which are to be turned up five inches all around. This foundation of sheet metal and brick and concrete shall extend under the whole of the fire box and ash pit of such steam boiler or furnace or other structure, and to a distance of not less than ten feet in front and at least four feet on the other three sides of the same. The space between the tops of such steam boilers or furnaces and any wood ceiling construction shall in no case be less than three feet, and the under side of such wood ceiling construction shall in all cases be protected either by two consecutive coatings of plastering on metallic lath or wire netting, which shall be kept at least two inches distant from each other, and which metallic lath or wire netting shall be applied by means of metal-furring strips, or this protection of the woodwork shall be made by a covering of at least two inches of porous terra cotta plastered on the under side, or by a covering of hollow tile with two air spaces at least $\frac{1}{2}$ inch each between the wood and the under surface thereof, which under surface shall also be covered with a heavy coat of plastering.

SEC. 132. **Cupolas of Foundries.**—Cupolas of foundries shall extend at least ten feet above the highest point of any roof within a radius of forty feet of such cupola and shall be covered on top with wire netting.

SEC. 133. **Pipes for Distribution of Hot Air.**—Where pipes are used for the distribution of hot air in buildings, such pipes must be made of metal and double. The space between the two metal pipes shall be at least $\frac{1}{2}$ inch. Such pipes are to be made with air-tight joints and to be securely fastened to the partitions through which they pass.

SEC. 134. **Registers—Openings in Floor For.—Material for Ducts, Pipes and Registers.**—The openings in floors for hot-air registers shall be surrounded with borders of incombustible material not less than two inches wide, and firmly and securely set in place, and bedded in plaster of paris. The register boxes shall be double, the distance between the two thicknesses of tin being at least one inch.

Where the air conveyed through pipes is heated in an ordinary hot-air furnace, or in any other apparatus, by direct contact of the air with a fire box, the material used for these double ducts, pipes and register boxes shall be in bright tin, and the joints shall be double-seamed, but not soldered. Where the air is heated by contact with hot water or steam pipes, any other sheet metal may be used for the pipes, and the use of double pipes is not obligatory.

SEC. 135. **Thickness of Walls of Class I.**—The following regulations shall govern the construction of buildings belonging to Class I:

The thickness of their surrounding walls and of all dividing walls in the same, carrying the load of floors or roof, shall be made as indicated in the following table, to wit:

	Basement.	STORIES.											
		1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.
One-story	12	12											
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

SEC. 136. **Stairs, Shafts, Shaving Pits—Walls Surrounding.—Ventilating Ducts, Chutes—Walls Surrounding.**—The walls surrounding stairs, and also the walls of elevator shafts and shaving pits, shall not be less than eight inches thick, and their thickness shall be increased with increase of height to a sufficient extent to keep the load on the brickwork within the maximum load elsewhere herein specified. No 8-inch wall shall be more than two stories high and not more than twelve feet high between lateral supports. Walls surrounding ventilating ducts, and rubbish and ash chutes, shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained.

SEC. 137. **Exception to Table of Thickness of Walls.**— If buildings of Class I are erected of less depth than 100 feet from front to rear or between cross walls, or if the walls supporting their floors and roof are less than twenty-five feet apart, the thickness of the walls given in the aforesaid table may be reduced by four inches, excepting only that no wall in such buildings shall be less than twelve inches thick.

SEC. 138. **Ice Houses.**— Houses to be used exclusively for the storage of ice may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; 8-inch brick walls with proper foundations of masonry may be used for such envelopes; iron or slate may be used, but no coating of mineral substance, or "fireproof paint," so called, shall be considered as incombustible, and such houses shall be used for no other purpose than the storage of ice.

SEC. 139. **Stairs in Class I.**— In buildings of Class I, which are used as workshops or in which, if they are used as salesrooms, there is an occupation of the same at any time by 100 or more persons, there shall be at least two staircases, each not less than four feet wide. If the number of persons occupying such buildings exceeds 300, then the width of the stairs in the same shall be increased to five feet. If the number of persons occupying such premises exceeds 800, three stairways five feet in width each shall be constructed. And if the number of persons occupying such premises exceeds 1,200, they shall be governed as regards the number, size and construction of stairways, by the regulations laid down for buildings of Class IV.

In all cases the stairs shall be located at as great a distance as practicable from each other.

The foregoing specifications as to stairs apply to non-fireproof buildings only. For fireproof buildings, one less flight of stairs than above called for may be sufficient in each case, unless the floor area exceeds 7,000 square feet, in which case there shall not be less than two stairs in any building of Class I.

And no stairways shall hereafter be constructed around or alongside elevator shafts in buildings over four stories in height, unless said stairways are separated from the elevator shaft by a fireproof wall.

SEC. 140. **Stairs and Fire Escapes — Obstruction of.**— It shall be unlawful, under any circumstances, to close up or obstruct during the occupation for business purposes of any building, the stairs or fire escapes or the approaches leading thereto, and no change in the position or construction of either shall be made, unless the permission so to do of the Building Department first shall have been obtained.

SEC. 141. **Door Openings at Street Level — Class I.**— The aggregate width of door opening at the street level in buildings of Class I shall be equal to the aggregate width of stairways hereinbefore specified, and such doors shall not be locked during business hours or while such buildings are occupied by large numbers of people.

SEC. 142. **Increasing Height of Class I.**— In all cases where buildings of Class I, already built, of ordinary construction, are to be increased in height above the height of 60 feet or above the height of 100 feet, the additional parts of such buildings shall be constructed as herein provided for buildings over 60 feet high or over 100 feet high, respectively, and shall be made to conform in all respects and throughout their entire extent to the requirements of buildings of this class more than 60 feet or 100 feet high, respectively, before it shall be lawful to occupy them.

SEC. 143. **Space Between Ceiling and Roof of Class I.**— In buildings of Class I, if the enclosed space between the ceiling and the roof is of less average height than six feet, then the ceiling and roof and all the structural parts of the same are to be made either of "mill construction," or "slow burning"; and in all cases means of access satisfactory to the Fire Marshal shall be given to this space between ceiling and roof.

SEC. 144. **Doors and Windows When Provided with Shutters.**—Wherever the distance between doors and windows of buildings on opposite sides of alleys or courts shall be 30 feet or less, such door or window openings shall be provided with shutters made of iron, wire glass or prisms, not exceeding four inches square, glazed in fireproof metal. The wire glass or the prisms to be set in hollow iron frames.

SEC. 145. **Dividing Walls—When Required in Class I.**—Dividing walls will be required in buildings of Class I as follows: For buildings of ordinary construction if their floor area exceeds 9,000 square feet; for buildings of slow-burning or mill construction if their area exceeds 12,000 square feet; for fireproof buildings if their area exceeds 15,000 square feet. In each of the before-mentioned cases such buildings shall be subdivided by brick walls built of the thickness given in the table for the thickness of enclosing walls, and all doors and other openings in such walls shall have iron doors or shutters at each side of same. And the buildings so subdivided shall be treated as regards stairs and fire escapes the same as two or more separate buildings.

SEC. 146. **Openings Inserted in Dividing Walls.**—If openings are to be inserted in dividing walls, as before described, or in dividing walls between non-fireproof and fireproof buildings or parts of buildings, they shall be made as follows:

They shall have doors placed on each side of each opening in such walls, which doors shall be made of No. 12 plate iron with a continuous 2 by 2 by $\frac{3}{8}$ inch angle iron frame extending all around the same and the plate riveted thereto with $\frac{1}{2}$-inch rivets, placed four inches between centers. If such doors are made double they must have cross bars, levers,

and hooks so arranged that when the doors are closed they will be of strength equal to that of a single door. All doors must be hung on frames made of ¾ by 4 inch iron stiffened with an angle iron extending all around the same and fitting up snug to the wall. The frames must be fastened to each other by bolts extending through the wall, such bolts being not more than two feet apart, and such doors must swing on three hinges, and must be made to fit closely to the frame all round. The sills between the doors must be of brick, iron, stone or concrete and must rise at least two inches above the floor on each side of each opening. The lintel over the door must be made of brick or iron, and the wall between the two door frames must be covered with a coat of plaster at least ½ inch thick.

SEC. 147. **Elevator Buildings—Bins of.—Cupola and Enclosure Walls of.—Outside Openings Into.—Openings in Body of First Story and in Boiler Houses.**—Elevator buildings (which term shall be interpreted as including all buildings intended solely for the receipt, storage and delivery of grain in bulk) may be constructed with bin walls, both externally and internally, made entirely of wood; provided, such walls are made solid and without cellular open spaces within them. The external bin walls shall have a covering of brick or hollow tile not less than twelve inches thick, which shall be united to the bin walls by anchors, in the construction and arrangement of which due allowance is made for the variations of shrinkage of the enclosing wall and of the wooden bin wall. If the weight of the bins is independently carried on a skeleton construction of timber, steel or iron, the first-story walls shall be of brick, not less than twenty inches thick. If the outer walls of the outside bins and their facing are not carried on a skeleton construction, then the first-story wall shall not be less than twenty-eight inches thick, or as much thicker as may be required to keep the load upon the brickwork within the limits of stress elsewhere specified in this ordinance.

The cupola or enclosure walls of elevator buildings shall be made of hollow tile not less than six inches thick; anchor the framework as above specified.

The outside openings in elevator buildings shall have protections of wire netting made of No. 14 wire, with meshes not over ½ by ½ inch.

All openings in the body of first story of elevator buildings, and the openings in the engine and boiler houses of the same, and between these and the main building, shall have iron doors.

SEC. 148. **Thickness of Walls of Classes II and III.—Exception to Above.**—Buildings of Classes II and III shall conform to the following requirements:

The thickness of enclosing walls of buildings of this class shall be made in accordance with the following table to-wit:

	Basement	STORIES											
		1st.	2d.	3d.	4th.	5th.	6th.	7th	8th.	9th.	10th	11th.	12th.
Basement and	12	8	...										
Two-story	12	12	8			..	...			..	...		
Three-story	16	12	12	8								. ..	
Four-story	20	16	16	12	12								
Five-story	20	16	16	16	12	12						..	
Six-story	20	20	16	16	16	12	12						
Seven-story	24	24	20	20	16	16	12	12			...		...
Eight-story	24	24	24	20	20	16	16	12	12		...		
Nine-story	28	24	24	20	20	20	16	16	12	12	...		
Ten-story	28	24	24	24	20	20	20	16	16	12	12		
Eleven-story	28	28	24	24	24	20	20	20	16	16	12	12	
Twelve-story	32	28	28	24	24	24	20	20	20	16	16	12	12

Three-story apartment houses or flats shall have the third story wall 12 inches in thickness instead of 8 inches as above.

SEC. 149. **Supports for Joists.**—If in buildings of Class II the distance between the enclosing walls is more than twenty-four feet in the clear, there shall be intermediate supports for the joists, which supports shall be either brick walls or iron or steel columns and beams. If brick walls are used for this purpose they may, in all cases where the thickness of walls is given in the table as sixteen inches or more, be made four inches less in thickness than the dimensions stated in the table.

SEC. 150. **Dividing Walls and Partitions in Apartment Houses, Boarding or Lodging Houses and Hotels.**—In all apartment houses, the dividing walls or partitions between the apartments provided for each family shall be made entirely of incombustible material. In boarding houses, lodging houses, or hotels, sixty feet or less in height, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material or of stud partitions filled the full thickness and height with mineral wool, or substance equally as good, and plastered on metal lath, separating these eight rooms from the contiguous spaces.

SEC. 151. **Fire Stop in Hotels, Lodging Houses and Boarding Houses.**— In hotels or lodging houses or boarding houses, 90 feet or less in height, there shall be a fire stop of brick, concrete or tile, between the ceiling and floor in each floor of joists for each twenty-five feet or fractional part thereof measured in the direction of the length of joists.

SEC. 152. **Stairs in Class II.— Office Buildings — Meaning of.— Stairs in.**— Stairs in buildings of Class II shall be adapted, in number and width, to the area, height, and to the uses to be made of the building in which they occur.

For office buildings, by which shall be understood buildings divided into apartments intended for business uses only, and in which there shall be no sleeping apartments whatever, there shall be in buildings of ordinary construction and of less ground area than 2,000 square feet, one flight of stairs not less than five feet wide, or two flights not less than three feet wide each; and for office buildings of ordinary construction and of greater ground area than 2,000 square feet, there shall be an additional flight of stairs for each additional 2,000 square feet of ground area, or for any fractional part thereof. For office buildings of slow-burning or mill construction there shall be at least one flight of stairs not less than five feet wide or two flights not less than three feet wide for the first 3,000 square feet of ground area, and an additional flight of stairs shall be required for each additional 3,000 square feet of ground area or fractional part thereof. For fireproof office buildings there will be required one flight of stairs not less than five feet wide for the first 5,000 square feet of ground area, and an additional flight for each additional 5 000 square feet of ground area or fractional part thereof.

SEC. 153. **Stairs in All Other Buildings of Class II.**— For all other buildings of Class II, there will be required for each building at least two flights of stairs which, for buildings of 2,000 square feet or less in ground area, shall be at least three feet wide each with an increase of six inches in width for each addition of 500 square feet to the ground area of the building up to a ground area of 3,000 square feet, and after that there shall be an additional flight of stairs not less than three feet wide for each additional 2,000 square feet of floor area or fractional part thereof In all cases where buildings of Class II are built entirely of fireproof construction, the number of stairs herein provided may be reduced by one flight from the number herein specified for non-fireproof buildings.

SEC. 154. **Rooms of Class II — When Considered Habitable.**— In buildings of Class II and III no room shall be considered habitable or used as a habitation unless it has at least one window of an area equal to one-tenth of the superficial area of such room, opening into the external air.

SEC 155. **Means of Communication with Outer Air of Buildings** — No space of less area than thirty-six square feet for each three-story building, or less area than forty-eight square feet for a four story building, and so on, increasing ten square feet for each additional story in height, shall be considered as affording means of communication with the outer air, and such open spaces or light shafts, if covered with a skylight or roof of any kind, shall not be considered as fulfilling the terms of this ordinance. This space must be left on land owned by owner of building in question.

SEC. 156. **Strength of Floors of Class I.**— No building of Class I shall be built with a strength of floor construction in any part thereof less than sufficient to carry, within the limits of stress for the different materials elsewhere herein specified, a load of 100 pounds for each square foot of floor surface; and the strength of such building shall be increased above the capacity to carry 100 pounds per square foot of floor surface, if the uses to which such building or part thereof is to be applied involve greater stress.

SEC. 157. **Display of Placard Indicating Strength of Floors.**— It shall be the duty of the owner of every building of Class I, already constructed, or hereafter to be constructed, or of his agent, or of the occupant of the same, to affix and display conspicuously on each floor of such building, a placard stating the load per square foot of floor surface which may with safety be applied to that particular floor, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the load indicated upon such placards. It shall be the duty of occupants of buildings to maintain such placards during their occupation of the premises, and the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be part of the duty of architects of all buildings to calculate the figures for such placard, which are to be verified and approved by the Commissioner of Buildings before they are affixed upon the respective floors of the different buildings.

SEC. 158. **Allowance for Live Load in Constructing Floors of Classes II and III.— Determining Strength of Posts and Area of Foundation of Classes II and III.**— For buildings of Classes II and III, except office buildings, including frame buildings outside of the fire limits, the floor shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface in such floors. For office buildings and for all buildings of Classes IV and V the live load above referred to shall be 100 pounds per square foot.

In determining the area of foundation for many-storied buildings in buildings of Classes II and III, allowances are to be made for the fact that the before mentioned live load is but

an occasional load, which rarely occurs simultaneously upon corresponding parts of many floors, and if so, for a very brief period only.

SEC. 159. **Strength of Roofs.**—The roofs of all buildings of every kind and class, including frame buildings outside of fire limits, shall be designed and constructed in such manner that they will bear a load in addition to their structure and covering of at least twenty-five pounds for each square foot of horizontal surface.

SEC. 160. **Ordinance—Not Considered as Requiring Alteration of Building.—Altering Building to Make Conform to Ordinance.**—Excepting in cases where the immediate safety of the occupants of buildings is concerned, nothing in this ordinance shall be considered as requiring alteration in the construction or equipment of buildings existing at the time of the passage of this ordinance and at that time complying with the ordinance at that time in force. If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make change in its use or occupation which will transfer it from one class as recognized by this ordinance to another, then before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, the entire building shall be reconstructed or modified in such manner as to bring the same when enlarged or altered, or when occupied for its new and different purposes, in accordance with the provisions of this ordinance.

SEC. 161. **Increasing Thickness of Walls of Altered Building.**—If the walls of such building are not of sufficient thickness to comply with the requirements of this ordinance for the enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than 12 inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall must be laid in cement mortar and must be anchored to the old wall (bonding with brick or masonry will not be considered as complying with this ordinance); and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified.

SEC. 162. **Party Walls.**—The foregoing shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls which at the time of their erection were built in accordance with the terms of the building ordinance then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

SEC. 163. **Foundation of New and Old Walls.**—In all cases where there is such increase of walls, a new foundation shall be built in such manner as to carry jointly both the new and old walls, and the soil under such foundation shall not be loaded beyond the limits elsewhere herein specified.

SEC. 164. **Class IV—Definition of.—Class V—Definition of.—Outside Walls of Classes IV and V.**—Buildings of Class IV embrace all buildings in which no movable scenery is used upon the stage thereof.

Class V embraces all buildings in which movable scenery is used.

The outside walls of all buildings of Classes IV and V, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more, shall have walls as follows:

If the walls are less than 25 feet high, not less than 20 inches thick.

If more than 25 feet and less than 45 feet high, the walls shall not be less than 24 inches thick.

If more than 45 feet and less than 60 feet high, the walls shall not be less than 28 inches thick.

If the walls are over 60 feet and less than 75 feet high, they shall not be less than 32 inches thick.

If more than 75 feet and less than 90 feet high, the walls shall not be less than 36 inches thick.

An increase of four inches in thickness of walls shall be made in all cases where walls are over 100 feet long without cross walls of equal height.

For rooms less than fifty feet wide, the thickness of walls before given may be reduced by four inches.

SEC. 165. **Structure Built Above Classes IV and V—Walls of.**—In case there should be one or more stories built above the room devoted to the uses of Classes IV and V, such stories being carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above every such room.

If solid masonry buttresses are employed, and placed sixteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel pillars are inserted in such walls for the support of the superstructure, and at distances not more than eighteen feet between centers, such pillars extending to and carrying the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of

strength afforded by such buttresses or pillars, but in no case shall any such wall be less than twelve inches thick in the top story, four inches being added going downward, for each story, or for each gallery, or for each twenty-five feet in height of blank wall.

SEC. 166. **Pillars in Walls.**— If iron or steel pillars are introduced in said walls the brickwork around the same shall be bonded into that of the connecting walls, and each of such pillars shall have no less than eight inches of brick wall around it, the brick being measured from the extreme outer dimensions of such iron or steel pillars.

SEC. 167. **Frontage of Class IV Seating Less Than 800.**— Buildings of Class IV, with seats for 800 persons or less, shall have a frontage upon two public spaces, of which at least one shall be a street, and of which the other, if it is not a street, shall be a public or private alley, not less than ten feet wide.

SEC. 168. **Frontage of Class IV—Seating Over 800.**— Buildings of Class IV of greater seating capacity than 800, and all buildings of Class V, shall face upon three open spaces, of which at least one shall be a public street, while the two others, if not streets, must be public or private alleys of a width of not less than ten feet each.

SEC. 169. **Class IV, Construction of.**— Buildings of Class IV, containing not more than 600 seats, may be built of ordinary construction. If they contain more than 600 and less than 1,500 seats, they shall be built of slow burning or of mill construction. If they contain more than 1,500 seats, they shall be built of entirely fireproof construction.

SEC. 170. **Class V—Construction of.**— Buildings of Class V, containing less than 1,000 seats, shall be of slow-burning construction or of mill construction, and if they contain 1,000 or more seats, they shall be built entirely of fireproof construction.

SEC. 171. **Classes I, II or III—Built in Conjunction with Classes IV or V.**— If buildings of Classes IV or V are built in conjunction with or as part of buildings devoted to the uses of Classes I, II or III, then such buildings of Classes I, II or III shall be built of fireproof construction, if the connected building of Class IV contains more than 1,500 seats, or if the connected building of Class V contains more than 1,000 seats.

SEC. 172. **Any Building Constructed with Classes IV or V.**— Any building higher than sixty feet and connected with or made part of any building of Classes IV or V shall be entirely of fireproof construction. Any building less than sixty feet in height and made part of any structure of Classes IV and V shall, if its case is not already covered by other provisions of this ordinance, be made of slow burning or mill construction.

SEC. 173. **Openings Between Now Fireproof Building and Classes IV or V.**— In all cases where fireproof construction is not used for the whole of such connected buildings, there shall be at each connecting opening double iron doors between such building of Class IV or V and the building connected therewith.

SEC. 174. **Spires, Cupolas and Domes Upon Houses of Worship and Instruction.**— Spires, cupolas or domes of non-fireproof material may be erected as part of any house of public worship or instruction, if the same is used for these purposes only, and if such house of public worship or instruction is so built that it is nowhere nearer than twenty feet to any line of the lot upon which it stands, street and alley lines excepted, and such non-fireproof spires or domes may be maintained only while this intervening space of twenty feet is made and maintained as part of the grounds of the owners of such house of public worship or instruction. In case the above is complied with, such spire or dome may be built with a framework of combustible material which shall, however, be covered on the outside with porous terra cotta, hollow tile or mortar, and upon this, with a weatherproof covering of sheet metal, slate or glazed tile, the same as elsewhere specified for roofs of the same type of construction.

SEC. 175. **If Conditions Violated, Spire, Cupola or Dome Must be Taken Down.— Roofs of Isolated Buildings of Class IV.**— If the twenty feet of vacant ground, before mentioned, as one of the conditions upon which the building of spires and domes having a combustible framework is permitted, should be built upon, then such spire or dome shall be taken down.

The roofs of isolated buildings of Class IV shall be constructed in the same manner as that provided for spires, domes and cupolas.

SEC. 176. **Limitations of Floor Levels of Classes IV and V.— Floor Level of Auditorium of Class V.—Exception to Above.**— The following limitations of floor levels in buildings of Classes IV and V shall be observed in all cases of new construction or reconstruction or alteration or improvement of existing buildings:

The floor level of the auditorium of the buildings of Class V shall be maintained within the limits of the first story thereof, and in all cases where such floors are banked or stepped up, the floor of the lowest banks shall not be above the sidewalk level. If the floor of the first story is level it shall not be higher than three feet above the sidewalk level.

The only exception to the foregoing shall be the case of rooms of Classes IV and V, containing less than 500 seats, which, in fireproof buildings, may be located in any story thereof, but in such case there shall be at least two flights of stairs from the floor in which such auditorium of Class V is located to the ground, and the width of such stairs shall not be less than four feet in the clear for each.

SEC. 177. **Auditorium Floor of Class IV—Height Above Sidewalk.**— In buildings of Class IV no auditorium containing more than 1,000 seats shall have the highest part of its

main floor at a greater distance than eight feet above the adjacent sidewalk grades. No room of Class IV containing more than 500 seats shall be at a greater distance from the sidewalk grade than thirty feet. No room of Class IV containing more than 200 seats shall be at a higher level above the sidewalk grade than forty-five feet.

SEC. 178. **Classes IV and V — Stairs of — Stairways of — Entrances and Exits of.**— Stairs in buildings of Classes IV and V shall be in width equivalent to eighteen inches for every 100 seats in such building — fractional parts of 100 being in each case counted as a full 100 seats — but no stairway in such building shall be less than four feet wide in the clear. All stairways shall have railings on each side thereof. No stairways shall ascend a greater height than eleven feet without a level landing, which, if its width is in the direction of the run of the stairs, shall not be less than three feet wide, or which, if at a turn of the stairs, shall not be of less width than that of the stairs.

Distinct and separate places of exit and entrance shall be provided for each gallery above the first. A common place of exit and entrance may serve for the main floor of the auditorium and the first gallery, provided its capacity be equal to the aggregate capacity of the outlets from the main floor and the said gallery.

SEC. 179. **Classes IV and V—Aisles of.— Steps in Aisles of.— Aisles and Passageways of — Kept Unobstructed.— Widths of Corridors — Passages — Hallways and Doors of.**— Aisles in buildings of Classes IV and V shall be in width equal to eighteen inches for every 100 seats or fractional part thereof, and the occupants of which will be required to use such aisles, but no aisle is to be less than two feet three inches wide in its narrowest part.

Steps shall be permitted in aisles only as extending from bank to bank of seats, and wherever the rise from bank to bank of seats is less than six inches the floor of the aisle shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a lamp at or near every place where there are steps in enclosing aisles or corridors.

All aisles and passageways in said buildings shall be kept free from camp stools, chairs, sofas and other obstruction, and no person shall be allowed to stand in or occupy any of said aisles or passageways during any performance, service, exhibition, lecture, concert, ball, or any public assemblage, nor shall there be any chair, settees or camp stools in such aisles or corridors at such times or occasions.

The width of corridors, passages, hallways and doors shall be computed in the same manner as that herein provided for stairways and aisles, excepting, however, that no corridor shall be anywhere less than five feet in width, and no door less than three feet wide.

SEC. 180. **Classes IV and V—Emergency Exits of.**— Emergency exits and stairways shall be provided outside of the walls of all buildings of Class IV seating more than 1,500 persons, and all buildings of Class V seating more than 800 persons. The aggregate width of such emergency exits, which shall be provided for each floor, balcony and gallery of such building, shall be one-half of that provided for the main exits, and no emergency exit, door or stairway shall be less than three feet in width. The framework of these stairs shall be made of iron, the treads of wood. These emergency exits are to be kept free of obstructions of all kinds, including snow.

SEC. 181. **Classes IV and V — Doors of, Open Outward — Walls Between Auditorium and Stage of.**— All doors in buildings of Classes IV and V shall open outward.

In buildings of Class IV and V there shall be a solid brick wall, of the same thickness as that called for on the outside walls, between the auditorium and stage; and in non-fireproof buildings this wall shall extend to a height of six feet above the roof. The main curtain opening shall have an iron or asbestos curtain, and all other openings in this wall shall have iron doors.

SEC 182. **Construction of Stage.**— The framing of the floor of every stage upon which movable scenery is to be used shall be of iron or steel. The stage floor may be of wood, but shall not be less than three and three-fourths inches thick. The entire floor construction and floor of fly-galleries and rigging lofts, and all railings and supports and stanchions thereon, as also all sheaves and pulleys and their supports, shall be of iron or steel. All woodwork, including the under side of floor boards, and also all scenery used on or about the stage, shall be coated with a fireproof paint, the qualities of which shall be submitted and approved by the Commissioner of Buildings in the manner hereinbefore provided for building materials generally. All wood used for floors and floor support in buildings of Classes IV and V shall be coated on the under side with the same kind of paint.

SEC. 183. **Structure Over Ceiling of Classes IV or V — Construction of.**— Structures of any kind, and for any purpose whatsoever, erected above the ceiling of any auditorium containing 500 or more seats, shall be entirely of fireproof construction, and shall not be larger in area than 70 per cent of the area of said auditorium.

If any structure is built over the ceiling or roof of any building of Class IV or V, the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner described for pillars of fireproof buildings of Class I.

SEC. 184. **Flue Pipe Over Stage of Class V.**— There shall be over the stage of every building of Class V a flue pipe of sheet metal construction, extending not less than fifteen (15) feet above the highest part of the roof over the stage of said building — flue shall have an area of at least one-thirtieth of the total area of the stage. The dampers for flue shall be made

of metal and opened by a close-circuit battery; a switch to be placed in the ticket office and one placed near the electrician's station on the stage, each to have a sign with these words printed on it: "Move switch to left in case of fire to get smoke out of building."

SEC. 185. **Automatic Sprinklers in Class V.**—In every building of Class V a system of automatic sprinklers to be supplied with water from a tank located not less than 20 feet above the highest part of roof of building. Sprinklers shall be placed above and below the stage; also in paint room, store room, property room and dressing rooms, if they are in or connected with Class V building, and not separated by approved double iron doors. Tank not to be connected to standpipe and ladder system, but to have separate pipe for filling from fire pump, and a 3-inch iron pipe extending from tank to outside of building, with siamese connections for fire department use. The entire sprinkler equipment to be approved by the Commissioner of Buildings, Fire Marshal and the Board of Underwriters of Chicago.

SEC. 186. **Diagram of Exits Printed on Programmes.**—It shall be the duty of the owner, lessee or manager of every building of Classes IV and V, during the performances of which programmes are issued, to cause a diagram showing the exits of such building to be printed on such programmes.

SEC. 187. **Sign Over Exits of Classes IV and V.**—All exits opening in buildings of Classes IV and V shall have the word "Exit," in letters at least six inches high, applied to the auditorium side and to the stage side of every exit.

SEC 188. **Fire Apparatus on Stage of Classes IV and V.**—In buildings of Class V, and also Class IV, where stationary scenery is used, there shall always be kept for use portable fire extinguishers or hand fire pumps, on and under the stage; in fly-gallery and in rigging loft, also at least four (4) fire department axes, two (2) twenty-five-foot hooks, two (2) fifteen-foot hooks, two (2) ten-foot hooks, on each tier or floor of the stage, all subject to the approval of the Fire Marshal.

SEC. 189. **Fire Alarm Telegraph Apparatus.**—Such buildings shall also be provided with a fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph, or such other place or places as the Fire Marshal shall direct.

SEC. 190. **Employment of Firemen in Class V.**—It shall be the duty of the owner, agent, lessee or occupant of any building of Class V, with accommodations for 1,000 or more persons, to employ one or more competent, experienced firemen, approved by the Fire Marshal, to be on duty at such theater during the whole time it is open to the public; such firemen shall report to and be subject to the orders of the Fire Marshal, and shall be in uniform and shall see that all fire apparatus required is in its proper place and in efficient and ready working order.

SEC 191. **License of Classes IV and V.**—The license for each building of Class IV and V shall state the number of persons it has accommodations for, and no more than that number shall be allowed to enter such hall at any one time, which number shall be governed by the number of feet of exit, of the doors and passages, and shall be approved by the Commissioner of Buildings.

SEC. 192. **All Parts of Classes IV and V Well Lighted During Performance.**—Every portion of any building of Classes IV and V devoted to the uses or accommodation of the public, also all outlets leading to the streets, and including the open courts and corridors, stairways and exits, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

SEC. 193. **Control of Lights in Halls, Corridors and Lobbies.—Connection with Gas Main.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Footlights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Protection of Stage Lights.**—For buildings of Class IV.—All gas or electric lights in the halls, corridors, lobby or any other part of said building used by the audience, except the auditorium, must be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying the building shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any part of the buildings, shall be provided with proper wire netting underneath. No gas or electric light shall be inserted in the walls, woodwork, ceilings, or in any part of the building, unless protected by fireproof materials in all buildings of Classes IV and V. The footlights, in addition to the wire network, shall be protected by a strong wire guard, not less than two feet distant from said footlights, and the trough containing said footlights shall be formed of and surrounded by fireproof materials. All border lights shall be constructed according to the best known methods, and subject to the approval of the Commissioner of Buildings and the Fire Marshal, and shall be suspended for ten (10) feet by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double, with an air space between them. All stage lights, if gas, shall have strong metal wire guards or screens, not less than ten (10) inches in diameter, so constructed that any material in contact therewith shall be out of reach of the flames of stage lights, and must be soldered to the fixtures in all cases.

SEC. 194. **Under Control of Fire Department and Commissioners.**—The standpipes, gas pipes, electric wires, hose, footlights and all apparatus for the extinguishing of fire, or guarding against the same, as in this section specified, shall be at all times made and kept in condition satisfactory to and under the control of the Fire Department, the Commissioner of Buildings and the Fire Marshal of the City of Chicago.

SEC. 195. **Commissioner and Fire Marshal Empowered to Enter Classes IV and V.**—The Commissioner of Buildings or Fire Marshal, or their respective assistants, shall have the right to enter any building of Classes IV and V, and any and all parts thereof, at any reasonable time, especially when occupied by the public, in order to properly judge of and discharge their respective duties; and it shall be unlawful for any person to refuse admission to such officers or to throw obstacles in the way of such officers while engaged in the performance of their duties.

SEC. 196. **Commissioner or Fire Marshal May Order Closed Classes IV or V.**—The Commissioner of Buildings or Fire Marshal shall have the power to order any building of Classes IV and V to be closed, where it is discovered that there is any violation of the provisions of this ordinance, until the same are complied with.

SEC. 197. **Mayor May Revoke License of Classes IV and V.**—Upon the report to the Mayor by the Department of Buildings, or of the Fire Marshal, that any order or requirement of this ordinance, in regard to Buildings of Classes IV and V, has been violated or not complied with, in any such building, the said Mayor shall revoke the license of such theater or place of public amusement, and cause the same to be closed.

SEC. 198. **Movable Awning—Erection of.**—All movable awnings hereafter erected shall be elevated at least eight feet at the lowest part thereto above the top of the sidewalk, and shall not project over the sidewalk to exceed three quarters of the width thereof. They shall be supported without posts, by iron brackets, or by an iron framework attached firmly to the building, so as to leave the sidewalk wholly unobstructed thereby. In all buildings of Classes I, II, IV and V the windows above the second story shall be so constructed as to permit the cleaning of them from the interior of the building, unless suitable stationary platforms, balconies or porches admit safe access to the outside of such windows.

SEC. 199. **Fixed Awnings—Erection of.—Width and Height of.**—Fixed awnings may be constructed over sidewalks as protection to the entrances of buildings, provided that such awnings are constructed of metal framework, filled with glass not less than three-fourths inch thick, and supported entirely from the structure of the building, and without posts or other obstructions upon the sidewalk.

Such awnings shall be of the width of the entrance which they protect, and shall extend over the entire width of the sidewalk in front of the same. The lowest part of such awnings shall be at least 12 feet above the sidewalk level.

Awnings projecting not over four (4) feet from building line may be ten (10) feet above the sidewalk at their lowest point.

SEC. 200. **Hatch Closers, in Elevator Shafts of Class I.—Commissioner and Fire Marshal to Examine.**—Wherever elevators in non fireproof buildings or in fireproof buildings of Class I are built without enclosing walls, there shall be at every floor through which they pass automatic hatch closers or automatic doors made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit.

Before any doors shall be considered as fulfilling the purposes of this ordinance, they shall be examined by the Commissioner of Buildings and the Fire Marshal, and if it is found by these officials that such doors will automatically close when the temperature at or near the same exceeds 140 degrees Fahrenheit, and that also the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and if there is nothing in their application or operation that is likely to cause accidents to, or interference with, the elevator service in the hatch holes which they are intended to close, then, and in such case only, shall the use of such hatch closers or doors be permitted.

SEC. 201. **Elevator Well, when Enclosed—Walls of.**—If such hatch holes are not supplied with hatch closers or doors, as before described, the elevator well shall be enclosed in all non-fireproof buildings with an entirely self-supporting wall of brick or tile extending from the foundation to a height of six feet above the roof of the building in which such elevator occurs, and in buildings of fireproof construction the walls or partitions enclosing such elevator shafts, which may be of light construction, but which must be incombustible, may be carried from story to story upon the construction of the same.

SEC. 202. **Elevator Shafts—Doors of.**—All elevator shafts and all elevator enclosures of every kind shall have iron doors which shall be made to open from the inside only, excepting only the door upon the ground floor of the building, which shall also have a lock to permit opening the same from the outside.

SEC. 203. **Elevator Shaft—Roof of.**—The roof of each elevator shaft shall be formed by a skylight, and to have ventilator at least 1-20 the area of the shaft. Skylights and ventilators may be omitted where there are windows in shafts opening on streets, alleys or courts.

SEC. 204. **Scaffolds — Erection of.— Floors During Building Operations.— Fine for Violation of Ordinance.—Commissioner May Revoke Building Permit—Architect Liable to Penalty.**—All scaffolds erected in this city for use in the erection, repair, alteration or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon, or passing under, or by the same, to prevent the falling thereof, or of any materials that may be used, placed or deposited thereon. It shall be the duty of all owners, contractors and builders, and all persons who shall have the supervision or control of the construction or remodeling of any building more than thirty feet high, to put in and lay upon the upper side of the joists or girders of each story in any building as soon as the joists or girders are laid, a good and substantial temporary or permanent floor for the protection of employes and all persons engaged in or upon the construction of said building, wherein no unprotected opening shall be left; and it shall be unlawful to place or put up the joists or girders of another story until each lower floor is thus laid. And it shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings which shall be more than thirty feet high to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected.

Any person or persons violating the provisions of this ordinance shall be each fined in a sum not less than one hundred dollars nor more than two hundred dollars per day; and any permit granted for the construction of said building by the authorities of the City of Chicago may be revoked in the discretion of the Commissioner of Buildings of the City of Chicago. Any architect having charge of such building, who shall permit it to be constructed in violation of this ordinance, shall be liable to the penalties provided and imposed by this ordinance.

SEC. 205. **Walls — Erection of — Walls and Skeleton Framework Securely Braced — Foundations Protected.**— In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings must be kept securely braced and otherwise protected against the effects of the weather during all building operations. All foundations must be protected against the effects of frost, and frozen cement mortar shall not be used in connection with building operations.

SEC. 206. **Signs on Buildings.**— All signs placed on any building above the level of the second story of the same shall be made of incombustible material. Wooden signs shall not be made of greater width than two feet.

SEC. 207. **Fences — Height of.**— No wood fence shall be constructed of greater height than eight feet above the sidewalk grade, or eight feet above the surface of the ground, where no grade is established.

SEC. 208. **Storage of Lumber.**— No lumber shall be piled for the purpose of storage, seasoning or drying the same, within fifty feet of any planing mill or woodworking manufactory, nor within 100 feet of any private residence, unless the same has been erected since the establishment of such yard.

SEC. 209 **Classes I, II, III and IV — Fire Escapes and Standpipes On.— Class V — Fire Escape and Standpipe On.**— All buildings, Classes I, II, III, IV, of four or more stories in height, in the City of Chicago, shall be provided and equipped with one or more metallic standpipes and ladders combined, with cast-iron, wrought-iron or steel balconies, with suitable railings at each floor, and firmly secured to the outer walls, and in such locations and numbers as shall be satisfactory to the Commissioner of Buildings, the Fire Marshal and the Fire-Escape Inspector.

All buildings of Class V, with accommodations for 1,000 or more persons, shall have at least one three-inch iron standpipe and metallic ladder combined in the street or alley, on the outside of the building, from ground to roof, with hose attachments, close to a window or door at each floor or gallery.

All such fire escapes shall be put up and completed to conform to the buildings for which they are respectively intended and shall be inspected after completion, and if found in a perfectly safe and satisfactory condition, a certificate shall be issued by the Commissioner of Buildings to that effect upon payment of $1.

SEC. 210. **Anchors.— Balconies.— Ladders.— Standpipe.— Siamese.— Anchors for the Top of Standpipe.— Painting.**— All single and double fire escapes, with ladders, hereafter erected, shall be in strict accordance with the following specifications:

There shall be no less than three 1-inch square or 1-inch diameter round wrought-iron anchors to every six-foot balcony, and six for a twelve-foot balcony. Said anchors must pass through the wall of building and bolt on the inside with a ¾ x 2-inch nut and 3½-inch cast-iron washer back of nut, where the wall is not over twenty inches thick; but where wall is over twenty inches thick, anchors shall be inserted at least eight inches into the wall on an angle of thirty-five degrees.

The brace of anchors must at least be twenty inches spread, and pass into the wall four inches at bottom. No other anchors allowed without a special permit from the Commissioner of Buildings.

All balconies hereinafter erected must be either heavy cast-iron, iceproof, capable of sustaining a weight of 500 pounds to the square foot, or a steel balcony, as hereinafter described, capable of sustaining the same weight per square foot. The balcony frame will be made of

not less than 1½ x 3 angle iron, securely riveted together, with cross-bars every two feet, said bars to be punched one-half inch square every two inch, center, and ½-inch square iron forced through the same, leaving a manhole of not less than 24 x 24 inches. The cross-bars to be securely riveted to the angle-iron frame. The cross-bars for a balcony twenty-eight inches wide to be 1½ x ⅜ inch iron. Balcony frames over twenty-eight inches wide will be made of not less than 2 x ⅜-inch iron, to conform with the increased dimensions of iron in cross-bars; for thirty-inch balcony, 2 x ⅜-inch; for thirty-six inch balcony or over, 2½ x ⅜-inch. All balconies over this width must have a 2-inch "T" iron through the center of balcony for the bars to rest upon. Said balconies to have a substantial cast or wrought iron post every three feet, bolted to the balcony. No balcony will have less than two guard rails, same to be of wrought iron, or new pipe not less than three-fourths inches in diameter, and the ends to be anchored in the wall of building not less than ten inches on an angle of thirty-five degrees.

The ladder, where used in combination with the standpipe, must be bolted to said standpipe with short-topped bolts every four feet, and bolted to the balconies. Rungs of ladder to be ½-inch square iron, with the corners upward, so as to give a safe footing. Every other rung to be riveted and to be 14-inch centers. Where ladder is put up without a standpipe, the side guards must be 2 by ⅜ inch flat iron or 1¼-inch pipe. All ladders must be 17 inches or more between pipes. No secondhand pipe will be allowed to be used and will be condemned if found in this construction by the inspector.

The standpipe will be of the best 3-inch wrought iron, 7½ pounds to the foot, and a 2½-inch brass hose valve, of the city standard thread, will be attached to the standpipe at every outlet at each floor and on the roof. Inside of all buildings over 100 feet in height, there shall be one 4-inch standpipe, extending from pump to roof, also connection on first floor with two-way siamese conuection for Fire Department and check valve against pump; two hose connections on each floor and roof, with Fire Department thread and enough hose attached to reach any point of the floor.

There will be a two-way automatic siamese at the bottom of the standpipe, so that two steam fire engines can be attached to it without interfering with each other. Said siamese must be within easy reaching distance from the sidewalk and to be securely anchored to the wall of the building.

All the anchors for the top of standpipe and ladders must pass through the wall and bolt on the inside of same.

All work must be painted with two coats of the best mineral paint, and all holes must be filled up with the best cement.

That no such fire escape shall be constructed except upon a permit therefor, issued by the said Commissioner of Buildings upon the payment by applicant therefor to the City Collector of a permit fee of $2.

SEC. 211. **Location of Buildings for Storage of Petroleum, Etc.—Walls of — Floors of — Roofs of.**— Buildings designed for the storage of petroleum or articles of like nature shall not be less than 100 feet from any other building, and be constructed as follows, to wit:

Their walls shall not be less than sixteen inches thick, nor more than sixteen feet high; their floors shall be made of fireproof paving or concrete, upon the ground, which shall be at least five feet below the street grade; their roofs shall be of metal, to have fire walls eighteen inches high all around, not less than twelve inches thick, and have copings of incombustible material, and subject to the approval of the Fire Marshal of Chicago.

SEC. 212. **Storage of Petroleum, Gasoline, Etc., Within Limits of City.**— It shall be unlawful for any person, persons or corporation to store or keep for sale within the corporate limits of the City of Chicago, except in buildings constructed as provided for in the last preceding section, any crude petroleum, gasoline, naphtha, benzine, camphene, spirit gas, burning fluid or spirits of turpentine, exceeding a quantity of five barrels of fifty gallons each; and it shall be unlawful to keep for sale or on storage any refined carbon oil, kerosene or other products, for illuminating purpose, of coal, rock or earth oils, excepting such refined oils as will stand a fire test of 150 degrees Fahrenheit, and according to the method and direction of John Taglibue; and it shall not be lawful to keep any quantity of said articles exceeding one barrel of fifty gallons in any part of a building, excepting a cellar, the floor of which shall be five feet below the grade of the adjacent streets; and no crude petroleum, gasoline, naphtha, benzine, carbon oil, camphene, spirit gas, burning fluid or spirits of turpentine shall be kept or stored in front of any building, or on any street, alley, wharf, lot or sidewalk, for a longer time than is sufficient to receive in store or in delivering the same, provided such time shall not exceed six hours.

SEC. 213. **Buildings in Public Parks.**— Buildings in public parks shall be subject to the provisions of this ordinance.

SEC. 214 **Fire Limits of City.—Walls — Structures and Buildings Altered to Conform to Ordinance.**— The fire limits of the City of Chicago shall be as defined by existing ordinances.

No wall, structure, building or part thereof will hereafter be built, constructed, altered or repaired within the fire limits of the City of Chicago except in conformity with the provisions of this ordinance. No building already erected or hereafter to be built within said fire limits shall be raised, altered or built upon in such manner that, were said building wholly rebuilt or constructed after the passage of this ordinance, it would be in violation of any of its provisions.

SEC. 215. **Expense of Altering Buildings by the City Recoverable from Owner.**—Whenever, in the opinion of the Commissioner of Buildings, it shall be necessary to tear down, alter, repair or rebuild any building or portion of any building which is dangerous, defective or unsafe, or which is reported to the said Commissioner by the Commissioner of Health to be unfit for human occupancy, or which has been built in violation of any of the provisions of this ordinance, or of any ordinance regulating the construction of buildings hereafter to be passed, he shall cause such building or such portion thereof to be torn down, altered, repaired or rebuilt, or such work to be done thereon as he may deem necessary to render said building, or said portion thereof, safe, and the expense thereof shall be recoverable of the owner or owners of said building, in an action of assumpsit, with such other process as may be necessary to insure the collection of said expense.

SEC. 216. **Fines for Violation of Ordinance.**—Any person, firm, company or corporation who violates, disobeys, omits, neglects, or refuses to comply with, or who resists or opposes the execution of any of the provisions of this ordinance, shall be subject to a fine of not less than $25, nor more than $200; and every such person, firm, company or corporation shall be deemed guilty of a separate offense for every day such violation, disobedience, omission, neglect or refusal shall continue, and shall be subject to the penalty imposed by this section for each and every separate offense; and any builder or contractor who shall construct any building in violation of any of the provisions of this ordinance, and any architect designing or having charge of such building who shall permit it to be so constructed, shall be liable to the penalties provided and imposed by this section.

SEC. 217. **Municipal Code—Sections of Repealed.**—That sections of the Municipal Code of Chicago of 1881, numbered as follows: 612 to 620, both inclusive; 623 to 651, both inclusive; Sections 990 to 1140, both inclusive, except Section 1109; also an ordinance relating to building permits passed October 3, 1887, and all ordinances and parts of ordinances in conflict with the provisions of this ordinance, are hereby repealed.

SEC. 218. **Ordinance in Force after Passage.**—This ordinance shall be in force from and after its passage.

SEC. 219. At the expiration of thirty days after the printing and publication of said building ordinances, each and every person, agent, firm, company or corporation engaged within the limits of City of Chicago in the construction or repairing of the whole or any part of buildings and appurtenances, shall be and he or it is hereby required to obtain a license from the City of Chicago, which shall permit him or it to engage thereafter in the business of contracting for the erection of buildings and appurtenances or parts thereof.

Every application for such license shall be made on printed blanks furnished by the city, and shall set forth the name and residence or place of business of the applicant, and the nature of the contracts which he or it desires to engage in for a period of one year thereafter, and shall be accompanied by a fee of $2.

The city shall thereupon issue a license in due form, permitting the applicant to engage in the business of contracting for the erection of buildings and appurtenances, or parts thereof, in the City of Chicago, for one year from the date of such license, which date shall be the first day of May in the year in which such license is applied for, and no license shall be granted for any period less than a year, and all licenses shall run from the first day of May in each year until the 30th day of April in the succeeding year. The applicant shall also receive, free of charge, with his license, a copy of said compilation of the building ordinances and all building ordinances which may be passed after the publication of said compilation.

Nothing herein contained shall be construed as to make any change in the proper fees as now prescribed in the city ordinances to be paid to the City of Chicago for every 25 feet of street frontage so used.

Any person, agent, firm, company or corporation who shall, after the date fixed, as aforesaid, for the issuance of licenses, engage in the business of building in the City of Chicago, under contracts for the whole or any part of buildings and appurtenances, without first having obtained a license therefor, as aforesaid, shall be deemed guilty of a misdemeanor for each day's violation of the provisions of this ordinance, and shall be subject to a fine for each offense of not less than $25 nor more than $100.

All fees and fines collected under the provisions of this ordinance shall be set aside and constitute a fund to defray the expense of the compilation and publication of the building ordinances of the city, as aforesaid, and from time to time, as may be required, and any surplus shall from time to time be paid into the general fund.

The People's Gas Light and Coke Co.

Michigan Avenue and Madison Street

CHICAGO

Supplying Gas in Chicago for...

ILLUMINATION
COOKING
HEATING and
POWER...

All inquiries regarding burners, piping or installation of gas-consuming appliances will receive prompt attention.



BAKE QUICKLY
USE LITTLE GAS
They are Popular with Tenants

MADE BY

GEORGE M. CLARK & COMPANY, CHICAGO.

72-74-76 Lake Street.

RULES FOR PIPING BUILDINGS

For Distribution of Manufactured and Natural Gas,

ISSUED BY

THE PEOPLE'S GAS LIGHT AND COKE COMPANY, CHICAGO.

MANUFACTURED GAS FOR LIGHT AND FUEL.

1. The following table shows the proportionate size and length of tubing allowed to be run :

Size of Tubing.	Greatest Length Allowed.	Greatest Number of Openings.	Size of Tubing.	Greatest Length Allowed	Greatest Number of Openings.
⅜ inch.	20 feet.	2	1½ inch.	150 feet.	60
½ "	30 "	3	2 "	200 "	100
¾ "	60 "	10	2½ "	200 "	200
1 "	70 "	15	3 "	200 "	300
1¼ "	100 "	30			

No ¼-inch pipe must be concealed, and only six feet for one opening may be used as risers and drops for bracket lights of unconcealed work.

2. The risers in any building must not be less than eighteen inches from the floor for two, three and ten openings ; two feet six inches for fifteen and thirty openings ; four feet for fifty and one hundred openings.

Where meters are to be set on the wall, no riser must be higher than nine feet from the floor.

3. No riser in any building must be less than ¾ of an inch, except where there are but three openings, when ½ inch will be allowed. In buildings with double parlors the drops must be ½ inch, with a set from the main line of pipe of not less than four inches, dropped square, and well secured by gas hooks to the joists, the same to be observed on all cross-lines of pipe. Drops and side openings, where nipples are used, must be made secure by lock nut or solder to prevent them turning inside the plaster, and must be well secured by gas hooks ; and where a coupling or L is used on the drop, then a strap or lock nut must be soldered to the drop and fastened to the joists with screws.

4. The rise pipes in all buildings must be carried up an inside partition out of the reach of frost, and must be placed where the meter and stopcock can be readily

got at, for the convenience of the consumer to turn off the gas, and for the employes of the Company to read the index and put the meter in order when required, and in no case will a meter be set where it will be exposed to damp or frost, or be liable to injury from any cause.

5. In all cases where extensions are made, care must be taken to break pipe where the rule for sizes can be kept, and in no case must extensions be made from small pipe.

6. All openings must be closed with iron caps, and in no case will lead caps be allowed. No split pipe or broken fittings repaired with cement or lead will be allowed.

7. All pipes must be examined by the inspector of this Company before being concealed, and due notice must be given by the fitter when any pipe is ready for inspection.

8. For churches, theaters or public buildings, where large chandeliers, reflectors, or sun burners are to be used, the pipes must be of sufficient size.

9. For gas logs and gas stoves, pipe must not be less than ¾ inch; each log or stove to count as two openings.

10. All work must be proved with mercury gauge. All risers must be brought to or near a wall or partition by the gasfitter.

It is the intention of the Company strictly to enforce the above rules, and no certificate of inspection will be given when they are not complied with. To avoid trouble, architects are requested to allow no bill for gasfitting unless accompanied by a certificate of inspection.

NATURAL GAS FOR FUEL.

Systems of piping must conform to these specifications before they will be accepted by the Company's inspectors and before connection will be made with the Company's mains.

1. Piping must be tested with air at a pressure of five pounds to the square inch. At this pressure a mercury column will stand at a height of ten inches, and it must remain stationary at that height until passed by the Company's inspector, and before a certificate of inspection will be issued. All pipes must be examined while exposed.

2. Due notice shall be sent to the Company's office by the gasfitter when any pipe is ready for inspection.

3. The following table shows, in each case, the smallest size pipe which will be accepted, to supply one each of the various appliances:

CLASSIFICATION OF APPLIANCES.	Size of Pipe.	Greatest Length of Pipe Allowed.
Gas cooking range	¾ inch.	30 feet.
Ordinary coal range equipped for use of gas	¾ "	30 "
Small portable gas cooking stove	½ "	20 "
Kitchen boiler heater, when separate from range	½ "	20 "
Small portable gas heating stove	½ "	20 "
Large heating stove	¾ "	30 "

CLASSIFICATION OF APPLIANCES.	Size of Pipe.	Greatest Length of Pipe Allowed.
Gas log or other grate fire	¾ inch.	30 feet.
Hot-air furnace for heating ten-room buildings, or less	1¼ "	70 "
Hot-air furnace for heating ten to fifteen room buildings	1½ "	100 "
Low pressure steam or circulating water boiler for heating ten-room houses or less	1½ "	100 "
Low pressure or circulating water boiler for heating ten to fifteen room houses	2 "	140 "
Miscellaneous appliances consuming less than fifteen cubic feet of gas per hour each	½ "	20 "
Miscellaneous appliances consuming fifteen to forty cubic feet of gas per hour each	¾ "	30 "
Miscellaneous appliances consuming forty to seventy-five cubic feet of gas per hour each	1 "	60 "
Low pressure or circulating water boiler for heating sixteen to twenty-six rooms	2½ "	200 "
Low pressure or circulating water boiler for heating twenty-seven to forty-five rooms	3 "	300 "
Low pressure or circulating water boiler for heating forty-six to seventy-five rooms	4 "	400 "

For special purposes, not provided for above, apply to the Company for information.

4. Half-inch pipe is the smallest size which will be allowed.

5. If more than one stove or other appliance is to be supplied from one run of pipe, the size of this run shall be increased proportionately to the amount of gas it will be expected to supply. For instance, it requires a ¾-inch pipe to supply a gas cooking range; if a large heating stove were to receive its supply of gas from the same run of pipe which supplied this cooking range, the run should be 1¼-inch pipe instead of ¾-inch.

6. If the above rules concerning the size of pipes are not clearly understood in each case, communicate with the Company's inspector. If unusual conditions are met, which the above rules do not cover, communicate with the Company's inspector.

7. No main riser will be allowed of less than 1-inch pipe, and risers must be placed out of the reach of frost, and must be located:

a That the meter can be placed conveniently for reading the index.

b That the meter will not be exposed to damp or frost, or be liable to injury from any cause.

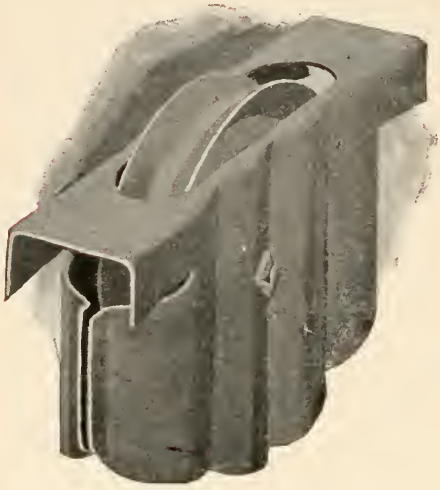
c That the stopcock placed at the inlet side of the meter can be readily reached by the consumer and the Company.

d That the meter will not be placed more than eight feet from the ground.

8. Where outlets are provided for, but remain closed, iron caps must be used. No split pipe or broken fittings repaired with cement or lead will be allowed.

9. Where systems of piping are concealed within plaster, or between floors, if side openings or nipples are used, joints must be made secure with solder or lock nuts to prevent turning inside the plaster, or between floors. All pipes must be supported with iron straps or gas hooks.

The Fox Patent All-Steel Sash Pulley



No. 3 C "FOX-ALL-STEEL" SASH PULLEY

BEAUTIFUL,
LIGHT,
STRONG.

Made complete from **Polished Steel, finished in Antique Bronze, Plain Bronze or Nickel Plate** for extra high-grade work.

NO NAILS, NO SCREWS.

NO LARGE OPENINGS to present an unsightly appearance.

PERFECT IN SIZE—each part is made in duplicate steel dies.

NOISELESS and
EASY RUNNING,

because *the double-shouldered steel bushing* runs on *the double-shouldered steel axle.*

NO OTHER PULLEYS have such perfect mechanical construction.

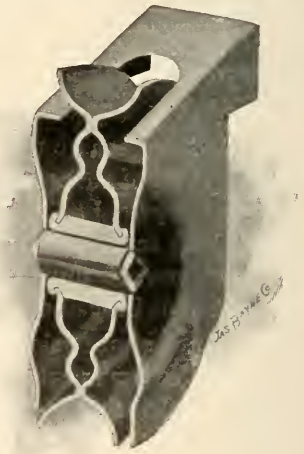
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They are cheap as well, quality considered.

See that "The Fox-All-Steel" are embodied in all your subsequent specifications.

STYLE "B" may be inserted with the ordinary pulley mortiser.

STYLE "C" has corrugated sides. **Just bore four holes** and drive in flush. **Our Post Boring Machine** and **Quadruple Bit** will bore the four holes at one operation, and are valuable tools for general work.



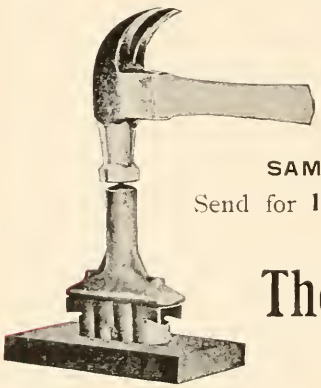
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Further particulars will interest you.

Ask your dealer for them, or order direct of the makers.

SAMPLE PULLEY FREE.

Send for **Illustrated Catalogue and Prices.**



PULLEY SET.

The Fox Machine Co.

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GRAND RAPIDS, MICH.



QUADRUPLE BIT.

10. In all cases where extensions are made, care must be taken to break pipe where the rule for sizes can be maintained, and in no case shall extensions be made from small pipe.

In the interest of the Company's patrons, and the best gas service, the above rules and regulations will be rigidly enforced. Strict compliance with each will be necessary to obtain a certificate of inspection.

EQUIPMENT OF BOILERS AND FURNACES FOR NATURAL GAS AS A FUEL.

LOW-PRESSURE STEAM AND HOT-WATER CIRCULATION BOILERS.

1. There must be a globe valve on main line leading to the header, within easy reach, which will shut off gas entirely from the header.

2. Valves on header must be so placed that no one valve will control the gas supplied to more than four burners.

3. A union must be left between the first valve on the header and the nearest fitting on the pipe, in order that the regulating valve may be put in without disturbing the header or burners.

4. Sheet iron or fire brick must be placed between the mixers and the top of burners in such a way as to entirely exclude air from the fire box, except what passes through the mixers.

HOT-AIR FURNACES.

1. Use O'Reilly or Vulcan round sectional burners.

2. Burners from fourteen to eighteen inches in diameter must be of at least three sections, with a separate valve controlling the supply of gas to each section.

3. Burners twenty inches in diameter or more must be of at least four sections, with a separate valve controlling the supply of gas to each section.

4. Burners must be placed so that the outside rim of the burner will be not less than one inch, or more than two inches, from the sides of the fire pot.

5. Burners should be placed on a level with the center line of the fire if coal is used; usually about four inches above the grate line.

6. There must be a globe valve on main line leading to the header, within easy reach, which will shut off gas entirely from the header.

7. A union must be left between the first valve on the header and the nearest fitting on the pipe, in order that the regulating valve may be put in without disturbing the header or burners.

8. Sheet iron must be placed between the mixers and the burners in such a way as to entirely exclude air from the fire box, except what passes through the mixers.

SIZE OF DRILLS.

1. For 2-inch Bunsen tube burners for steam or hot-water boilers, use 3-16 Morse drill for each burner.

2. For hot-air furnaces, use No. 19 Morse drill for each section.

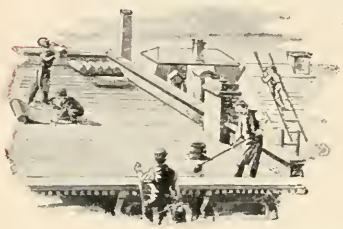
In case of any unusual appliances which the above specifications do not provide for, apply to this office for information.

This company will not approve the use of natural gas in appliances not equipped according to the above rules and regulations.

ASBESTOS ROOFING AND SHEATHING FELTS.

FIRE-PROOF.
WATER-PROOF.
WEATHER-PROOF.
ACID-PROOF.
VERMIN-PROOF.
NO COAL TAR.
NO WOOL.
NO SHODDY.

TRADE MARK ASBESTOS



ASBESTOS PIPE AND BOILER COVERINGS

THE MOST EFFICIENT AND DURABLE COVERINGS PRODUCED.



ASBESTO-SPONGE FELTED AND FIRE-FELT COVERINGS.

MADE IN SECTIONS FOR PIPES, SHEETS FOR BOILERS AND OTHER LARGE SURFACES. NEVER POWDER OR DISINTEGRATE. UNAFFECTED BY VIBRATION OR MOISTURE. PROOF OF EFFICIENCY FURNISHED ON APPLICATION.

ASBESTO-SPONGE MOLDED SECTIONAL AND BLOCK COVERING.

SPECIAL COVERINGS FOR LOW-PRESSURE HOT AND COLD WATER PIPES. ALSO, COVERINGS FOR BRINE AND AMMONIA PIPES.

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THE STANDARD PAINTS FOR STRUCTURAL PURPOSES. PREPARED IN 56 STANDARD SHADES READY FOR THE BRUSH. ALSO FIREPROOF AND FIRE AND WATER PROOF PAINTS.

SUGGESTIONS FOR "ARTISTIC HOUSE PAINTING" A SPECIALTY.



SHINGLE STAINS, WOOD STAINS, VARNISHES, ETC.

THE BEST THERE IS IN PAINT.

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NEW YORK. PHILADELPHIA. BOSTON.

ASBESTOS AND ITS USES.

Asbestos, which a few years ago was comparatively unknown, is rapidly becoming recognized as a most durable, efficient and economical material for structural, mechanical and electrical purposes.

It is frequently considered only with regard to its remarkable heat-resisting character, seemingly without a knowledge of its many other valuable qualities, which are as numerous as the purposes for which it may be utilized.

In common with manufacturers of other special materials of merit, the manufacturers of asbestos products have been greatly annoyed, and the results of years of experiment and large expenditure of money nearly wasted, by the willingness of many to purchase adulterated goods made in imitation of the genuine article.

Among the many materials made wholly or in part of asbestos, and which are of special interest to architects and builders, we have had our attention called to the following :

Asbestos roofing, made of layers of asbestos felt saturated and cemented together with an acid and water proof composition, having a foundation of burlap and furnished in rolls thirty-two inches wide, with coatings, nails, etc., for its proper application.

The special advantages of the asbestos roofing are, that it is proof against decay, being unaffected by heat, cold, acids, gases or moisture ; its extremely light weight (about 100 pounds per square when applied on the roof), and the fact that it can be applied by any careful workman, make it unnecessary to employ experienced roofers.

While this roofing is especially adapted for manufacturing buildings, warehouses and other large structures, it may also be used on dwellings, apartments and store buildings. It requires but little attention to keep in repair, and taken in comparison with metal or tar and gravel roofing, has many points of superiority in weight, durability and its fireproof feature.

Roofing and insulating felts are also made of this same indestructible asbestos felt, saturated with the acid and water proof composition, in various thicknesses and weights, and also in two-ply and three-ply for roofing purposes. No wool or other materials liable to decay, nor any coal-tar products, are used in these felts.

They are desirable for lining and insulating buildings, as they are durable and are proof against fire.

They may also be furnished unsaturated or coated without being saturated with the composition.

Special materials made of asbestos for fireproofing walls, ceilings and floors include "Asbestos Superator," made of asbestos with a foundation of wire netting, millboard, fire felt and cements ; also asbestos fireproof paints.

The question for insulation for steam pipes, boilers and hot-water pipes is daily becoming of greater importance and its necessity recognized by all steam users.

Asbestos is a foundation of heat-resisting coverings, and while it is largely used as a medium of strength combined with other materials of a combustible nature with reasonable success and efficiency, particularly where used on low-pressure steam pipes, it is durable, and when properly made is among the most efficient coverings in the market.

Among the best grades of asbestos coverings may be mentioned asbestos-sponge felted, asbestos fire felt and asbestos-sponge molded. These are furnished in sectional form for pipes and in sheets and blocks of special dimensions and thicknesses for larger fire or steam heated surfaces.

The list of articles made from this interesting and valuable mineral are almost limitless, including cloth for screens, theater curtains, clothing and gloves, rope for fire escapes, etc.; also electric insulation.

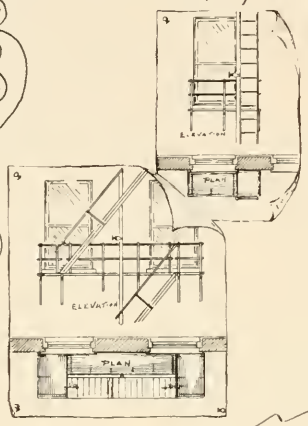
A more careful investigation of the subject of asbestos products would undoubtedly prove of great value to architects and their clients.

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WRITE FOR ESTIMATES

HAMMILL FIRE ESCAPE CO.

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MANUFACTURERS OF
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STAND PIPES AND LADDERS
STAIRWAY FIRE ESCAPES
IRON BALCONIES AND RAILINGS
IRON STAIR WORK OF ALL KINDS
ICE PROOF BALCONIES AND LADDERS

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AUTOMATIC
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PROTECTION
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AGENTS
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MANUFACTURERS OF

The Improved Standpipes and Fire Escapes..

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CHICAGO

AN ACT

RELATING TO FIRE ESCAPES FOR BUILDINGS.

Approved May 27, 1897.

SECTION 1. **Fire Escapes to be Put on Certain Buildings Within Three Months — Kind of.** — *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That within three (3) months next after the passage of this act all buildings in this State which are four or more stories in height, excepting such as are used for private residences exclusively, but including flats and apartment buildings, shall be provided with one or more metallic ladder or stair fire escapes attached to the outer walls thereof, and provided with platforms of such form and dimensions, and such proximity to one or more windows of each story above the first, as to render access to such ladder or stairs from each such story easy and safe, and shall also be provided with one or more automatic metallic fire escapes, or other proper device, to be attached to the inside of said buildings so as to afford an effective means of escape to all occupants who, for any reason, are unable to use said ladders or stairs; the number, location, material and construction of such escapes to be subject to the approval of the inspector of factories: *Provided, however*, that all buildings more than two stories in height, used for manufacturing purposes, or for hotels, dormitories, schools, seminaries, hospitals or asylums, shall have at least one such ladder fire escape for every fifty (50) persons, and one such automatic metallic escape, or other device, for every twenty-five (25) persons, for which working, sleeping or living accommodations are provided above the second stories of said buildings; and that all public halls which provide seating room above the first or ground story shall be provided with such numbers of said ladder and other fire escapes as said inspector of factories shall designate.

SEC. 2. **All Buildings to be Provided with Fire Escapes for the Purposes Set Forth in Section 1.** — All buildings of the number of stories and used for the purposes set forth in Section one (1) of this act which shall be hereafter erected within this State shall, upon or before their completion, each be provided with fire escapes of the kind and number and in the manner set forth in this act.

SEC. 3. **Duties of Factory Inspectors — Notice to Owners of Buildings.** — It shall be the duty of said inspector of factories to serve a written notice, in behalf of the People of the State of Illinois, upon the owner or owners, trustees or lessees, or occupant, of any building within this State not provided with fire escapes, in accordance with the requirements of this act, commanding such owner, trustee, lessee or occupant, or either of them, to place or cause to be placed upon

such building such fire escape or escapes as provided in Section one (1) of this act, within thirty (30) days after the service of such notice. And the grand juries of the several counties of this State may also, during any term, visit or hear testimony relating to any building or buildings within their respective counties for the purpose of ascertaining whether it or they are provided with fire escapes in accordance with the requirements of this act, and submit the result of their inquiry, together with any recommendations they may desire to make, to the Circuit Court, except in Cook County, and to the Criminal Court of Cook County, and said court may thereupon, if it find from the report of said grand jury that said building or buildings is or are not provided with a fire escape or escapes in accordance with this act, cause the sheriff to serve a notice or notices upon the owner, trustee, lessee or occupant of such building or buildings.

SEC. 4. **Owners or Trustees Subject to Fine.**— Any such owner or owners, trustee, lessee, or occupant, or either of them, so served with notice as aforesaid, who shall not, within thirty (30) days after the service of such notice upon him or them, place or cause to be placed such fire escape or escapes upon such building as required by this act and the terms of such notice, shall be subject to a fine of not less than twenty-five or more than two hundred dollars, and to a further fine of fifty dollars for each additional week of neglect to comply with such notice.

SEC. 5. **Erection and Construction of all Fire Escapes to be Under Supervision of Inspector of Factories.**— The erection and construction of any and all fire escapes provided for in this act shall be under the direct supervision and control of said inspector of factories, and it shall be unlawful for any person or persons, firm or corporation to erect or construct any fire escape or escapes, except in accordance with a written permit first had and obtained and signed by said inspector of factories, which permit shall prescribe the number, location, material, kind and manner of construction of such fire escape.

SEC. 6. **Application for a Permit to Erect Fire Escapes to be Filed in the Office of the Inspector of Factories.**— Any person or persons, firm or corporation, who shall be required to place one or more fire escapes upon any building or buildings, under the provisions of this act, shall file in the office of said inspector of factories a written application for a permit to erect or construct such fire escape or escapes, which application shall briefly describe the character of such building or buildings, the height and number of stories thereof, the number of fire escapes proposed to be placed thereon, the purposes for which such building or buildings is or are used, and the greatest number of people who use or occupy or are employed in such building or buildings above the second stories thereof at any one time.

SEC. 7. **Act of 1885 Repealed.**— That an act entitled "An act relating to fire escapes for buildings," approved June 29, 1885, in force July 1, 1885, be and the same is hereby repealed.

Public Notice and Regulations for Examinations

BY THE

Board of Examiners of Architects of the State of Illinois.

Secretary's Office and Headquarters of the Board:
ROOM 1112 CHAMBER OF COMMERCE BUILDING, CHICAGO.

Board of Examiners of Architects:
DANKMAR ADLER, Chicago, President; PETER B. WIGHT, Chicago, Secretary and Treasurer; N. CLIFFORD RICKER, Urbana; WILLIAM ZIMMERMAN, Chicago; WILLIAM H. REEVES, Peoria.

DECEMBER 3, 1897.

Notice is hereby given to all persons desiring an examination for license to practice the profession of architecture in the State of Illinois, under the provision of "An Act to provide for the licensing of Architects and regulating the practice of Architecture as a Profession" (approved June 3, 1897), which went into effect on the said first day of July, 1897, that they may now apply for the same under the provisions of section 4 of said act.

For the information of those who desire to take out licenses, the act has been printed in full by the Board of Examiners of Architects, and copies will be furnished on application, as also forms of application for examination with affidavit attached, that have been approved by the board.

The regular examinations will be held June 21 and 22 at the University of Illinois, at Urbana.

Applications will be received at all times.

If the number and urgency of the applications received make it seem expedient to the board to institute examinations at any other times, due notice of such additional examinations will be forwarded by the secretary to those whose applications are on file at his office.

Applications for the regular examinations should be at the secretary's office one week before the date set.

All applications must be upon the form provided, and must be accompanied by the examination fee of $15. Examinations will be of two days' duration.

If the applications are in regular form, notice will be mailed to applicants, with detailed information as to the time, place and extent of examination.

Due notice will be sent of the result of the examination. If the applicant has failed, the examination fee will be returned; if accepted, the candidate will be notified that the license fee of $25 is due, on receipt of which the license will be forwarded by mail, and will be a receipt for the fee. All licenses issued before July 1, 1898, will run from July 1, 1897. All licenses issued after the June examinations will run from July 1, 1898. All licenses will bear the date of the time when finally approved by the board.

All licenses will be for life, subject to the powers of revocation vested in the board by the above mentioned act, and a fee of $5 to be paid in each following month of July during the term of the license.

By order of the Board,

PETER B. WIGHT, *Secretary*.

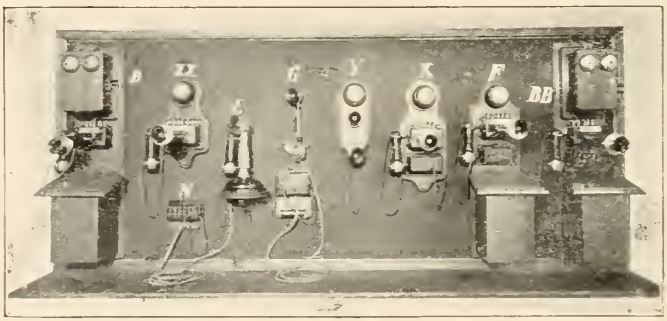
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OFFICE AND FACTORY:

72-82 W. Jackson Blvd., CHICAGO, ILL.

AN ORDINANCE

Providing for a Department of Electricity.

Passed and in force January 24, 1898.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That Paragraphs 589 to 598, inclusive, of Chapter XXV, and Paragraphs 623 to 628, inclusive, of Chapter XXVI, of the Revised Code of Chicago, 1897, be and the same are hereby repealed.

SEC. 2. That in lieu thereof the following ordinance is hereby enacted and numbered by paragraphs as follows, and designated as a part of Chapter XXV of the Revised Code of Chicago, 1897, viz :

CHAPTER XXV.

DEPARTMENT OF ELECTRICITY.

589. **Department Created.**— There is hereby established an executive department of the municipal government of the City of Chicago, which shall be known as the Department of Electricity, which shall include a City Electrician, an Assistant City Electrician, a Superintendent of Construction, a Chief Clerk, two bookkeepers, two stenographers, one chief inspector and nine assistant inspectors, and such other assistants and employes as the City Council may by ordinance establish.

590. **City Electrician.**— There is hereby created the office of City Electrician, who shall be the head of said Department of Electricity, who shall be a practical and skilled electrician, and who shall not be engaged in any other business while acting in said capacity. He shall hold his office for the term of two years, and until his successor shall be appointed and qualified. He shall be appointed by the Mayor, by and with the advice and consent of the City Council, whenever a vacancy exists in said office by removal or otherwise.

591. **Bond — Approval of.**— Said City Electrician, before entering upon the duties of his office, shall execute a bond to the City of Chicago, in the sum of $20,000, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

592. **Powers — Subordinate Officers — Bonds — Salary.**— He shall have the management of the fire alarm telegraph and police telephone systems, of municipal electric lighting, of the inspection of all electric wiring within the city limits, both inside of buildings and above, beneath and upon the surface of the streets, and of all electrical matters in which the city is interested, and shall appoint, by and with the consent of the Mayor and in accordance with law, all subordinate officers and assistants named herein, and that may hereafter be provided for, and may remove them for inefficiency or neglect of duty in accordance with law.

Provided, that the Fire Marshal shall have control of all fire alarm operators, repairers and first-class linemen, and all matters pertaining to the actual operation of the fire alarm telegraph, and the location of call boxes.

All those operators, repairers and first-class linemen, including the present Chief of Construction of the Fire Alarm Telegraph, who at present are or who may hereafter be members of the Fire Department, shall be detailed for duty by the Fire Marshal to the City Electrician, and this ordinance shall in no way be construed as separating them from said Fire Department.

And provided, also, that in all matters pertaining to the operation of the electrical service of the Police Department, the said City Electrician shall consult with the Superintendent of Police, and in case of a disagreement in any of said matters between said City Electrician and said Superintendent of Police, the Mayor is hereby given the power to decide such matters of difference.

All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said City Electrician. Said City Electrician shall require good and sufficient bonds to be given by all subordinate officers and employes in said department who shall receive or have the care, custody or handling of any money belonging to the City of Chicago, and said bonds shall be approved by the Mayor and Comptroller. The salary of the said City Electrician shall be $4,000 per annum.

593. **Assistant City Electrician — Qualifications — Duty — Salary.**— There shall be appointed an Assistant City Electrician, who shall be a practical and skilled electrician, and who shall act as City Electrician in case of the absence of the City Electrician from his office, and while so acting shall discharge all the duties and possess all the powers invested in and imposed upon the City Electrician. The salary of the Assistant City Electrician shall be $3,250 per annum.

594. **Superintendent of Construction — Powers — Duty.**— There shall be appointed a Superintendent of Construction, whose duty it shall be to put in new circuits and install all new work of the city under the direction of the City Electrician. His salary shall be $2,000 per annum.

595. **Other Officers — Powers — Duties — Salaries.**— There shall be appointed the several officers and employes of this department named in Paragraph 589 hereof, whose appointment is not hereinbefore provided for, and the powers, duties and salaries of such officers and employes shall be such as may be required and prescribed by the City Electrician, the rules and regulations of this department, and the ordinances of the city.

596. **Electric Current.**— No electric current shall be used for illumination, decoration, power or heating, except as hereinafter provided.

597. **Application — Contents — Permits.**— All persons, firms or corporations desiring to install wires or other apparatus for the use of electric currents for any of the purposes mentioned in the preceding section of this chapter, shall before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the City Electrician, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number; and upon receipt of which application, if found proper, such permit shall be given.

598. **Duties of City Electrician Thereon.**—The said City Electrician shall then have power, and it shall be his duty, when by him deemed necessary, to carefully inspect any such installation previous to and after its completion, and it shall be competent for him to remove any existing obstructions which may prevent a perfect inspection of the current-carrying conductors, such as laths, plastering, boarding or partitions; and if such installation shall prove to have been constructed in accordance with the rules and requirements of the Fire Department of the City of Chicago, controlling the use of electric current, upon the payment of a fee, as herein provided, he shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of said inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of said certificate; provided, however, the City Electrician may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed.

598a. **Preliminary and Final Certificate.**— A preliminary certificate may be issued by said City Electrician, in the case of completed installations, but upon which no current will be used in the immediate future. Such preliminary certificate shall show that at the date of inspection the installation was erected in accordance with the terms of this chapter, and shall

be issued at one-half the rates hereinafter named. Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation is still in accordance with the terms of this chapter, a complete and final certificate shall issue, and the amount of the fee paid for the preliminary certificate shall be deducted from the fee for the final certificate. Any owner or owners of property installing electric wires to be hidden from view shall, prior to such installation, give said City Electrician a reasonable notice in order to give ample time for inspection.

598b. **Power of City Electrician — Penalty.**— The said City Electrician is hereby empowered to inspect or reinspect all overhead, underground and interior wires and apparatus conducting electric current for light, heat or power, and when said conductors or apparatus are found to be unsafe to life or property, shall notify the persons, firms or corporations owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person, firm or corporation failing or refusing to repair, change or remove the same within forty-eight hours after the receipt of such notice, shall be subject to a penalty of ten ($10) dollars for each and every day such conductors and apparatus continue to be in an unsafe condition.

598c. **Poles — Covers — Wires — Branded and Tagged.**— All poles now standing or hereafter erected, and all covers for manholes now in service, or hereafter placed in service, for the use of electric conductors shall be branded or stamped with the name of the person, firm or corporation owning the same; and all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner of and giving such a full description of the conductors as shall meet with the approval of said Superintendent.

598d. **Fees.**— There shall be collected by the said City Electrician and paid into the treasury of the City of Chicago, upon the issuance of certificates permitting the use of electric currents, the following fees:

For each light, the sum of $1.

For each incandescent lamp of nominal 16 candle-power, and for larger or smaller lamps in that proportion, 10 cents.

For each electrical horse-power of 746 watts, used for mechanical or other purposes than above mentioned, $1.

But no inspection shall be made for a less amount than $1.

Inspection of temporary installations for show-window exhibitions, conventions and the like shall be charged for by the time required for such inspection, at the rate of, per hour, 50 cents.

For each reinspection of any overhead, underground and interior wires or apparatus there shall be collected by said Superintendent at the rate of one-half of the fees prescribed in this section.

598e. **Record — Annual Report.**— It shall be the duty of the said City Electrician to keep records containing a full and accurate account of all inspections made and of all moneys received; he shall annually, on or before the first day of February in each year, prepare and present to the City Council a report showing the receipts and expenditures and entire work of his department during the previous fiscal year; and he shall at the same time send to the Comptroller a full and comprehensive statement of all matters pertaining to his department, together with an estimate in detail of the appropriations required by the department during the next municipal year.

598f. **Alterations.**— No alterations shall be made in any installation without first notifying the said City Electrician and submitting the same for similar inspection, as above provided.

598g. **Penalty.**— Any person or persons who shall use any electric current in violation of any of the provisions of this chapter shall be subject to a penalty of not less than fifty nor more than one hundred ($100) dollars, and to a further penalty of ten ($10) dollars for each day during which he or they shall continue such violation. Said City Electrician may for any violation of this chapter order and compel the cutting off and stopping such current until the provisions of this chapter are fully complied with.

SEC. 3. This ordinance shall take effect and be in force from and after its passage, and all ordinances or parts of ordinances in conflict herewith are hereby repealed.

AN ORDINANCE

Creating a Board of Examiners of Plumbers, and providing for the examination and certification of plumbers.

Passed and in force January 31, 1898.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That any person now engaged in, or hereafter engaging in, or working at, the business of plumbing in the City of Chicago, either as master plumber or employing plumber, or as a journeyman plumber, shall obtain a certificate as to his or her competency to engage in such business in such manner as is hereinafter provided.

SEC. 2. Any person now engaged in the business of plumbing, or who may desire to engage in such business, either as a master plumber or employing plumber, or as a journeyman plumber, shall make application to the Board of Examiners, hereinafter provided for, and shall, at such time and place as said Board may designate, undergo such examination as to his qualifications and competency to engage in such business, or to continue to engage in such business, as the said Board of Examiners may direct. Said examination may be made, in whole or in part, in writing, and shall be of a practical and elementary character, sufficiently strict, however, to test the qualifications of the applicant.

SEC. 3. There is hereby created a Board of Examiners of Plumbers, consisting of three (3) members, one of whom shall be the Commissioner of Health, who shall be (ex-officio) chairman of said Board of Examiners; a second member who shall be a master plumber, and a third member who shall be a journeyman plumber. Said second and third members shall be appointed by the Mayor, by and with the advice and consent of the City Council, as soon as may be after the passage and approval of this ordinance, and the said two members first appointed shall hold office until the first day in May, 1899, and thereafter the second and third members to be appointed on said Board of Examiners shall be appointed by the Mayor, by and with the advice and consent of the Council, on the first day in May, 1899, and annually thereafter. Each of said second and third members so appointed shall, before entering upon the duties of their office, execute a bond to the City of Chicago, in the sum of $5,000, with sureties to be approved by the City Council, conditioned for the faithful performance of the duties of the office to which they have been appointed. The salary to be paid to each of the second and third members of the Board of Examiners shall be $1,500 per year.

SEC. 4. As soon as may be after the passage and approval of this ordinance, the Mayor shall appoint, by and with the advice and consent of the City Council, a Secretary to said Board of Examiners, and it shall be the duty of said Secretary to preserve and keep all records, books and papers which are required by law to be kept by, or filed with, said Board, and to do and perform such other services as may be from time to time required by the said Board of Examiners. The person first appointed Secretary shall hold office until the first Monday in May, 1899, and thereafter the Secretary to said board of Examiners shall be appointed by the Mayor, by and with the advice and consent of the City Council, on the first Monday in May, 1899, and biennially thereafter. The person appointed Secretary shall, before entering upon the duties of his office, execute a bond to the City of Chicago, in the penal sum of $5,000, with sureties to be approved by the City Council, conditioned for the faithful performance of the duties of his office. The salary to be paid said Secretary shall be $1,500 per year.

SEC. 5. Said Board of Examiners shall, as soon as may be after appointment, meet at such time and place as the Commissioner of Health may designate, and proceed to carry out the provisions of this ordinance. Said Board shall examine applicants as to their practical knowledge of plumbing, house drainage and plumbing ventilation; and if satisfied as to the competency of any such applicant, and upon receipt of the fee hereinafter provided for, shall issue a certificate to such applicant, authorizing him to engage in or work at the business of plumbing, either as master plumber or employing plumber, or as a journeyman plumber, as the case may be, and according to the terms of the application made by such applicant. Provided, however, that the issuance of the certificate and the payment of the examination fee, as herein provided, shall not entitle any master plumber or employing plumber to whom such certificate is issued, to engage in the business of master plumber or employing plumber in the City of Chicago until such master plumber or employing plumber has obtained a license so to do, in accordance with the provisions of Section 1415, Article 1 of Chapter 50 of the Revised Code of Chicago, 1897. The fee for the examination and certificate of a master plumber or employing plumber shall be five ($5) dollars, in addition to the sum charged for a license fee as provided for in Section 1415, Revised Code, as aforesaid, and for the examination and certificate of a journeyman plumber it shall be one ($1) dollar. All fees received for said examinations and certificates shall be paid into the City Treasury.

SEC. 6. The Commissioner of Health is hereby authorized to provide office room for the Secretary of said Board of Examiners in the offices of the Department of Health; and all records of the said Board of Examiners shall be considered and become a part of the records of the said Department of Health.

SEC. 7. The certificate herein prescribed for master plumbers shall be accepted in lieu of the examination provided for in Sections 1417, 1418, of the Revised Code of Chicago, 1897, which said section is hereby repealed in so far as it is inconsistent or in conflict with the provisions of this ordinance; but all other existing ordinances and sections of ordinances relating to plumbers and plumbing shall continue to be operative and in force, unaffected by the passage of this ordinance.

SEC. 8. Any person violating, disobeying, neglecting or refusing to comply with any of the provisions of this ordinance, shall be subject, on conviction thereof, to a penalty of not less than $5 nor more than $50 for each offense, and, upon such conviction, the certificate issued as herein provided may be revoked by the Mayor, on recommendation of the Commissioner of Health.

SEC. 9. All ordinances or parts of ordinances in conflict herewith are hereby repealed, and the ordinance passed by the City Council on December 13, 1897, as published on pages 1135, 1136 and 1137 of Council Proceedings, 1897, is hereby specifically repealed.

SEC. 10. This ordinance shall be in force and take effect from and after its passage and publication.

LAWS, ORDINANCES AND REGULATIONS

RELATING TO THE

VENTILATION, LIGHT, DRAINAGE AND PLUMBING OF BUILDINGS.

STATE OF ILLINOIS — REVISED STATUTES.

JAN. 1, 1889. CHAPTER 24-1.

AN ACT

For the Regulation and Inspection of Tenement and Lodging Houses or Other Places of Habitation. Approved and in force May 30, 1881.

286. SECTION 1. **Architect — Plans.**— *Be it enacted by the People of the State of Illinois, represented in the General Assembly,* That it shall be the duty of any architect or architects, builder or builders of, or other person or persons interested in any projected tenement, lodging house or other places of habitation in any incorporated city of fifty thousand (50,000) inhabitants, to submit plans and specifications of any such building or buildings to the Health Commissioner or Commissioners of such incorporated city, that the said Health Commissioner or Commissioners may examine the said plans and specifications, for his or their approval or rejection as to the proposed plans for the ventilation of rooms, light and air shafts, windows, ventilation of water-closets, drainage and plumbing.

287. SEC. 2. **Duty of Plumber.**— It shall be the duty of any plumber or other person or persons interested in the contract for the plumbing work of such building or buildings, to receive a written certificate of instruction from the Health Commissioner or Commissioners before commencing work on the said building or buildings, and to proceed according to the plans, specifications and instructions, as approved by the Health Commissioner or Commissioners of said city.

288. SEC. 3. **Health Commissioner — Notice.**— It shall be the duty of any plumber or other person or persons interested in the plumbing work, after the completion of said plumbing work, and before any of the said plumbing work is covered up in any building or buildings, or on the premises connected with said building or buildings, to notify in writing the Health Commissioner or Commissioners, that said building or buildings, or other premises, are now ready for inspection, and it shall be unlawful for any plumber, or other person or persons, to cover up or in any way conceal such plumbing work, in or about such building or buildings, until the Health Commissioner or Commissioners approve of the same.

289. SEC. 4. **Architect — Penalty.**— If any architect or architects, builder or builders, violate the provisions of this act, he or they shall be fined in a sum of not less than one hundred (100) dollars, nor more than two hundred (200) dollars for each offense.

290. SEC. 5. **Penalty — Plumber.**— If any plumber or other person or persons interested in the plumbing work, violate any of the provisions of this act, he or they shall be fined the sum of not less than one hundred (100) nor more than two hundred (200) dollars for the first offense, and the further penalty of ten (10) dollars for each and every day such plumber or other interested person or persons shall, after first conviction, neglect or refuse to comply with any provisions of this act, or the written instructions of the Health Commissioner or Commissioners, and for the second offense a like penalty and a forfeiture of his or their license to do business in said city for one (1) year after conviction.

291. SEC. 6. **Emergency.**— Inasmuch as the health of the people is endangered, an emergency exists requiring this act to take effect immediately, therefore, this act shall take effect and be in force from and after its passage.

REGULATIONS AND CERTIFICATE OF INSTRUCTIONS.

In Force March 1, 1897.

GENERAL CONDITIONS.

Certificate.— Owner or other interested parties should insist on receiving from the plumber a certificate of inspection, signed by the Chief Inspector and approved by the Commissioner of Health, showing that the plumbing work has been inspected as required by the city ordinance.

Plans.—A duplicate of building plans must be filed with the Department of Health before the original is approved; said duplicate shall be on paper or cloth and drawn to a standard scale, and show all drain pipes within building.

Ventilation of Rooms.— Every habitable room must have at least one window opening directly upon the street or yard, or upon a court or light shaft.

Light and Air Shaft.— Every light and air shaft for habitable rooms must be at least twelve square feet in area for a three-story house, sixteen square feet in area for a four-story house, and twenty square feet in area for a five-story house; and in every case not less than two feet wide in the clear. Shafts between two houses, and common to both, must be of double this area and not less than four feet wide.

Where the sides of the shaft are allowed by the Department of Buildings to be constructed of studding, they shall be extended above the roof not less than three feet, be covered with glass to admit light, and be provided with openings protected by slats so arranged as to admit air, said opening to be at least equal in area to the area of the shaft.

Alterations and Additions.—No alterations in the light and ventilation of any buildings or approved plans shall be made, except upon the express written approval of the Commissioner of Health; nor shall any additional structure be erected upon the lot except upon such approval and a special permit.

Windows.— The windows of habitable rooms which open on shafts shall be hung with weights so as to slide vertically, each window to be not less than twelve square feet in area.

VENTILATION OF WATER-CLOSETS.

Water-closets shall not be ventilated by a shaft which ventilates habitable rooms; and where they do not open otherwise to the external air, they must be ventilated by means of a separate shaft not less than ten (10) square feet in area, to extend above the roof, and to be arranged for the admission of light and air at the top, in like manner as the shafts for rooms.

The term "soil pipe" is applied to any vertical line of pipe, extending through roof, receiving the discharge of one or more water-closets, with or without other fixtures.

The term "waste pipe" is applied to any pipe, extending through roof, receiving the discharge from any fixtures except water-closets.

The term "vent or revent pipe" is applied to any special pipe provided to ventilate the system of piping and to prevent trap siphonage and back pressure.

All joints must be made with picked oakum and molten lead and be made gas-tight. Twelve (12) ounces of fine, soft pig lead must be used at each joint for each inch in the diameter of the pipe.

All wrought-iron and steel pipe must be equal in quality to "Standard," and be properly tested by the manufacturer. All pipe must be lap welded.

Wrought-iron and steel pipe must be galvanized.

Fittings for vent pipes on wrought iron or steel pipes may be the ordinary cast or malleable steam and water fittings, provided they are galvanized.

Each building must be separately and independently connected with the public or a private sewer.

The entire plumbing and drainage system of every building must be entirely separate and independent of that of any other building.

Every building must have its sewer connections directly in front of the building unless permission is otherwise granted.

The use of pipe hooks for supporting drains is prohibited.

Ice box or refrigerator waste pipes shall extend above the roof.

Fittings for waste or soil pipes must be the special extra heavy cast-iron recessed and threaded drainage fittings, with smooth interior waterway and threads tapped, so as to give a uniform grade to branches of not less than than ¼ of an inch per foot.

All joints to be screwed joints made up with red lead, and the burr formed in cutting must be carefully reamed out.

Outside leaders may be of sheet metal, but they must connect with the house drain by means of a cast-iron pipe extending vertically five feet above the grade level.

Cellar drains will be permitted only where they can be connected to a trap with a permanent water seal.

Subsoil drains should discharge into a sump or receiving tank, the contents of which must be lifted and discharged into the drainage system above the cellar bottom by some approved method.

Where directly sewer connected they must be cut off from the rest of the plumbing system by a brass flap valve on the inlet to the catch-basin and the trap on the drain from the catch-basin must be water supplied as required for cellar drains.

All pipe lines must be supported at the base on brick piers or by heavy iron hangers from the cellar ceiling beams and along the line by heavy iron hangers at intervals of not more than ten feet.

The house drain must properly connect with the house sewer at a point two feet outside of the outer wall of the building. An arched or other proper opening must be provided for the drain in the wall to prevent damage by settlement.

The house drain and sewer must be run as direct as possible, with a fall of at least one-quarter inch per foot, all changes in direction made with proper fittings, and all connections made with Y branches and one-eighth and one-sixteenth bends.

If possible the house drain must be above the cellar floor. The house drain must be supported at intervals of ten feet by 8-inch brick piers or suspended from the floor beams or be otherwise properly supported by heavy iron pipe hangers at intervals of not more than ten feet.

Inside leaders (rain pipes) must be made of cast iron, galvanized wrought iron or steel, with roof connections made gas and water tight by means of a heavy lead or copper drawn tubing, wiped or soldered to a brass ferrule calked or screwed into the pipe.

Full size Y and T branch fittings for handhole clean-outs must be provided where required on house drain and its branches.

Clean-outs must not be less than four inches in diameter.

All urinals must be constructed of materials impervious to moisture that will not corrode under the action of urine. The floor and walls of the urinal apartments must be lined with similar non-absorbent and non-corrosive material.

The entire plumbing and drainage system within the building must be tested by the plumber in the presence of the plumbing inspector, under a water and air test as directed. All pipes must remain uncovered in every part until they have successfully passed the test. The plumber must securely close all openings as directed by the inspector of plumbing The use of wooden plugs for this purpose is prohibited.

The water test will be applied by closing the lower end of the main house drain and filling the pipes to the highest opening above the roof with water. If the drain or any part of the system is to be tested separately, there must be a head of water at least six (6) feet above all parts of the work so tested, and special provision must be made for including all joints and connections in at least one test.

The air test will be applied with a force pump and mercury column under ten pounds pressure, equal to 20 inches of mercury. The use of spring gauges is prohibited.

After the completion of the work, when the water has been turned on and the traps filled, the plumber must make a peppermint test in the presence of a plumbing inspector and as directed by him.

The material and labor for tests must be furnished by the plumber. When the peppermint test is used, five ounces of oil of peppermint must be provided for each line up to five stories and basement in height, and for each additional five stories or fraction thereof one additional ounce of peppermint must be provided for each line.

Rubber connections shall not be used on any pipe or fixture which is connected with drain or sewer.

Double hubs shall not be used on soil, waste or vent pipes.

No house drain shall be less than six (6) inches, internal diameter.

ORDINANCE

Passed and in force November 30, 1891.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That in all buildings hereafter erected in the City of Chicago, and in all other buildings already built or erected, wherein the plumbing shall be repaired or changed, the drain, soil, waste pipes and traps must be exposed to view for ready inspection at all times and for convenience in repairing. When necessarily placed within partitions or in recesses they must be covered with woodwork, so fastened as to be readily removed. In no case shall they be inaccessible, unless placed so in accordance with a written permit from the Commissioner of Health.

SEC. 2. Where sewer connections are not extended to the level of the floor line, foot connections of soil and waste pipes shall be made with one-quarter or one-eighth long iron bends, and an iron sewer cap, such as is in general use, shall be used to finish the construction. When sewer is extended to the floor line an iron sewer cap shall be used to complete the construction.

SEC. 3. Where water closets are placed outside of buildings, the Chief Inspector must be notified before work is started.

SEC. 4. No brick, sheet metal, earthenware or chimney flue shall be used for a sewer ventilator, or to ventilate any trap, soil or waste pipe.

SEC. 5. Every vertical soil and waste pipe must be of iron, and it must extend above the roof at least twelve inches, and have a diameter of at least one inch greater than that of the pipe proper. But in no case shall it be less than four inches in diameter through and above the roof. The increaser must be placed at least one foot below roof. No cap or cowl shall be affixed to top of such ventilation pipe.

SEC. 6. Soil, waste and vent pipes in an extension must be carried above the roof of main building when otherwise they would open within twenty feet of the windows, doors or ventilators of main or adjoining buildings.

SEC. 7. Horizontal soil, waste and vent pipes are prohibited. Where rows of fixtures are placed in line, angle fittings must be used on vent pipes to prevent same from filling with rust or condensation. Trapped vents are strictly prohibited. No ventilation pipe from house side of any trap shall connect with any reventilation pipe or with any sewer, soil or waste pipe. Branches on main vertical vent pipes, where there is more than one fixture, must be taken out above the top of highest fixture.

SEC. 8. The least diameter of soil pipe permitted is four inches. A vertical waste pipe into which a line of kitchen sinks discharge must be at least three inches in diameter, if receiving the waste of five or more floors, and shall have two-inch branches.

SEC. 9. There shall be no traps at foot of soil or waste pipes.

SEC. 10. All iron pipes (cast) must be sound, free from holes or cracks, and of the grade known in commerce as extra heavy. The following weights per lineal foot will be accepted as complying with this ordinance:

2	inches,	5½	pounds per	lineal foot.
3	"	9½	"	"
4	"	13	"	"
5	"	17	"	"
6	"	20	"	"
7	"	27	"	"
8	"	33½	"	"
10	"	45	"	"
12	"	54	"	"

SEC. 11. All fittings used in connection with such pipe shall correspond with it in weight and quality. Tar or asbestos coated pipe shall be used.

SEC. 12. When required by the Commissioner of Health, all work must be tested by such test as this department decides upon, and in the presence of the Inspector. Defective pipes must be removed and all defective work made good and to conform to this ordinance.

SEC. 13. All joints on (cast iron) soil, waste and drain pipes must be so filled with oakum and lead and hand-calked so as to make them air-tight.

SEC. 14. All connections of lead waste or vent pipes shall be made by means of wiped joints, and brass solder nipples or combination ferrules. Wrought or cast iron nipples or ferrules must not be used.

SEC. 15. Every water closet, urinal, sink, basin, bath, and every set of wash trays, tub or sets of tubs, must be effectively and separately trapped. When floor washes are connected it must be by means of a deep seal trap. Traps on bath tubs must be placed in such a manner that the clean-out will be in plain view and above the floor.

SEC. 16. The traps must be placed as near the fixture as possible, and in no case shall a trap be more than two feet from said fixtures.

SEC. 17. In no case shall a waste from any fixture be connected with any water closet trap or revent connection for same.

SEC. 18. All traps must be connected from siphonage by special vent pipe. The vertical air pipe for traps of water closets in buildings more than four stories in height must be at least three inches in diameter, with two-inch branch for each water closet trap. This rule shall apply to all other fixtures except that branches may be same size as trap, and pipe may be reduced to two inches for two lower stories. Vent pipes for water closets in residences must be two inches, with same size branches, and for other fixtures not less than one and one-half inches, with branches same size as trap. All re-vents may be connected with increaser just below roof. (See Section 5.)

SEC. 19. No trap vent shall be used as a waste or soil pipe.

SEC. 20. All lead or other safes under fixtures must be drained by special pipe, same to discharge into sink or on cellar floor; and in no case shall the safe waste be connected with any waste, soil or drain pipe or sewer. The end of safe wastes shall be covered by flap valves.

SEC. 21. Overflow pipes from fixtures must be in each case connected on the inlet side of the trap.

SEC. 22. The drain pipe from refrigerator must not be directly connected with any soil or waste pipe, or with the drain or sewer, or discharge upon the ground; it must discharge into an open or water supplied sink. Such drain pipe must be so arranged as to admit of frequent flushing, and must be as short as possible and disconnected from refrigerator. The outlet should be covered by means of metal flap valve.

SEC. 23. The sediment pipe from boiler must be connected on inlet side of sink trap.

SEC. 24. Water closets must never be placed in an unventilated room or compartment. In every case the room or compartment must be open to the outer air or be ventilated by means of an air-duct or shaft. Interior water closets shall not be supplied from city supply pipes direct. All water closets within the house must be supplied from special tanks or cisterns, the water of which is not used for any other purpose. A group of water closets may be supplied from one tank; but water closets on different floors shall not be supplied from one tank. In tenement houses there must be a separate cistern for each water closet, excepting in a cellar or unfinished basement cistern may be dispensed with, and one water closet must be provided for each two families.

SEC. 25. The overflow pipes from water-closet cisterns may discharge into an open sink or where its discharge will attract attention and indicate that waste of water is occurring; but not directly into soil, waste, drain, vent or sewer pipe. When the city pressure is not sufficient to supply these cisterns adequate pumps must be provided.

SEC. 26. The valves or cisterns must be so fitted and adjusted as to prevent waste of water.

SEC. 27. Water closets when placed in the yard must be separately trapped and so arranged as to be conveniently and adequately flushed, and their water supply pipes and traps must be protected from freezing. The compartment for such water closets must be ventilated by means of slatted openings in the doors and roof.

SEC. 28. Tanks for drinking water, if indispensable, must not be lined with zinc or galvanized iron. They must be constructed of wood or iron or may be lined with planished copper. The overflow pipes shall discharge upon the roof or be trapped and discharge into an open sink; but never into any soil, waste pipe, water closet trap, drain or sewer. Discharge pipes from such tanks shall not be so constructed as to discharge into any sewer, connected soil or waste pipe.

SEC. 29. Rain water leaders shall not be used as soil, waste or vent pipes; nor shall any soil or vent pipe be used for a rain pipe. Where the leader opens near windows or light shaft it must be properly trapped far enough below surface to prevent freezing. The joint between leader and roof shall be air-tight. Sheet metal or slip joints shall not be allowed inside of any building.

SEC. 30. No steam, exhaust blow-off, or drip pipe shall connect with the sewer or with any house drain, soil or waste pipe. Such pipes shall be discharged into a tank or condenser from which a suitable outlet to the house drain shall be provided.

SEC. 31. Yards and areas shall be properly graded, cemented, flagged or well paved, and properly drained. When the area drains are connected to the house drain they must be effectively trapped and protected by means of back-water valves.

SEC. 32. Cellar and foundation wall shall, where possible, be rendered impervious to dampness, and asphaltum or coal tar pitch in addition to hydraulic cement shall be used for that purpose.

SEC. 33. The general privy accommodations of a tenement house or lodging house shall not be permitted in the cellar, basement or under sidewalks.

SEC. 34. Wooden wash-trays and sinks are prohibited inside of any building; they shall be of non-absorbent material.

SEC. 35. No catch basin shall be allowed in any building.

SEC. 36. Where a single water closet or other plumbing fixture is located in a building and has an independent soil or waste pipe of undiminished size, from ground (in building) to roof, the revent may be dispensed with; *provided*, the trap of said fixture is located not more than five feet from the said soil or waste pipe, and that no other fixture on the floors above or below are connected or will be connected into any pipe from the said single fixture. It is further provided that a non-siphoning trap, tested and approved by the Chief Inspector, shall be used for such work.

SEC. 37. Where two or more plumbing fixtures having an independent soil or waste pipe of undiminished size from ground in building to roof, are located on one floor, the revent pipe from the said fixtures may be branched into the soil or waste pipe, three feet above the floor on which the fixtures are located; *provided*, that no fixture or fixtures on the floors above or below are connected or will be connected into the soil, waste, vent or revents of the said fixtures. It is further provided that no fixture revented under this rule shall be more than eight feet from the main soil or waste pipe.

SEC. 38. Pan closets will not be allowed in any building.

SEC. 39. No privy vault will be allowed on premises where there is a main sewer in street. (See Sections 4956 and 4957.)

SEC. 40. Special permits will be issued by the Chief Inspector only. Where special permit is used the location must be inspected before work is started.

SEC. 41. The Commissioner of Health shall be notified in writing when work is ready for inspection.

SEC. 42. Any person or persons or corporation who shall violate any of the provisions of this ordinance shall, upon conviction, be subject to a fine not exceeding two hundred ($200) dollars, nor less than twenty-five ($25) dollars, for each offense, and a further penalty of not less than twenty-five ($25) for each day such violation shall be allowed or suffered to continue. And after the first fine shall have been imposed upon any person or persons having a plumber's license from the City of Chicago for any violation of any of the provisions of this ordinance, the Mayor may revoke the license of any such person or persons at once.

SEC. 43. That all ordinances or parts of ordinances conflicting with this ordinance be, and the same are hereby repealed.

SEC. 44. This ordinance shall take effect and be in force from and after its passage.

AN ORDINANCE REGULATING PRIVY VAULTS.

Passed June 25, 1894.

SEC. 4956. **Privy Vault, Unlawful Location of.**—*Be it ordained by the City Council of the City of Chicago:* § 1. That it is hereby declared to be unlawful for any person, firm or corporation to maintain any privy vault or suffer the same to be and remain upon any premises abutting upon or adjoining any street, alley, court or public place, in which is located any public sewer. Any person, firm or corporation violating the provisions of this ordinance shall be fined not exceeding two hundred dollars for each offense.

SEC. 4957. **When in Force.**— § 2. This ordinance shall take effect and be in force from and after its passage and due publication.

REGULATIONS FOR THE EXAMINATION OF STEAM BOILERS.

Revised Code of Chicago, 1897.

1936. **Office of Inspector Created — Term.**— There is hereby created the office of inspector of steam boilers, who shall hold his office for the term of two years, and until his successor shall be appointed and qualified.

1937. **Appointment.**— He shall be appointed by the mayor, by and with the advice and consent of the city council, on the first Monday in May, 1897, or as soon thereafter as may be, and biennially thereafter.

1938. **Qualifications.**— The person so appointed shall be a person well qualified from practical experience in the use and construction of boilers, generators and super-heaters, and their appurtenances, used for generating steam for power, steaming or heating purposes, to enable him to judge of their safety for use as such, and who is neither directly nor indirectly interested in the manufacturing, ownership or agency of steam boilers which are to be inspected.

1939. **Bond.**— Said inspector, before entering upon the duties of his office, shall execute a bond to the City of Chicago, in the sum of five thousand dollars, with two or more sureties, to be approved by the mayor, conditioned for the faithful performance of the duties of his office.

1940. **Duties.**— It shall be the duty of the inspector, upon proper application, to inspect all boilers used for the generation of steam power or for heating or steaming purposes, except in private residences, and all tanks subjected to steam pressure, used in any business, by making a careful examination of, and subjecting the same to a hydrostatic pressure, which shall exceed the maximum working pressure in the ratio of one hundred and fifty to one hundred pounds; and in no case shall the working pressure be more than one hundred pounds to the square inch for a new boiler, forty-eight inches in diameter, made of No. 1 iron plates of one-fourth of one inch in thickness, and the steam pressure of all boilers, whether thicker or thinner, larger or smaller than before mentioned in this section, shall be governed by the same standard of strength; Provided, however, that whenever the plates of which any boiler is made show thereon the manufacturer's stamp indicating its tensile strength, such boiler may be tested and rated in accordance with the United States steamboat inspection law governing the inspection of steam boilers.

1941. **Duty of Owners.**— It shall be unlawful for any person to use any steam boiler or any tank or tanks subject to steam pressure in this city, until he

shall have first procured a certificate from the inspector that it may be safely used; and, it shall be the duty of every person using any steam boiler or any tank or tanks subject to steam pressure, in this city, to have the same inspected by the inspector of boilers as often as once in each and every year thereafter; and, to that end, every owner or person using a steam boiler or tank aforesaid shall make or cause to be made, annually after such first inspection, an application in writing to the inspector requesting him to inspect the same.

1942. **Certificate — Record.**— When an inspection of a boiler or boilers, tank or tanks, generator or generators, super-heater or super-heaters has been made, and the same shall be approved by the inspector, he shall make and deliver to the person for whom the inspection was made, upon the payment to him of the fees hereinafter mentioned, a certificate of such inspection, which shall contain the date of inspection, together with a general description, for what purpose used, the number of try cocks, steam and water gauges, pumps, the pounds pressure to which said boilers have been tested, and the maximum pressure at which they may be safely used; which certificates shall be framed and put up in the office, or some other conspicuous place on the premises, for examination, and a record of the same shall be made by the said inspector, in a well-bound book, alphabetically indexed.

1943. **Inspection of Repairs.**— It shall be the duty of said inspector, on the written application of the owner or agent of any boiler, generator or super-heater, stating that the same is out of repair, or has been repaired, to examine the same when so repaired, and determine if the same has been properly done, and it shall be unlawful for any person to use any boiler, after the same has been repaired, until he shall have first procured a certificate from the inspector that it has been properly done and may be safely used.

1944. **Fees.**— Said inspector may charge a fee of three dollars for inspecting each boiler, which shall be paid by the party requiring such service before the delivery of such certificate; Provided, that in any establishment where more than one boiler is used said inspector shall only be entitled to said fee of three dollars upon one boiler, and to a fee of two dollars upon each and every additional boiler.

1945. **Charging Excess of Fee.**— If the inspector shall take or receive any money or other valuable thing from any person, other than the fees allowed by this chapter, for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if said inspector shall issue any certificate of inspection without having at the time stated thoroughly examined and tested the boiler so certified for, he shall be fined in the penal sum of one hundred dollars, and shall be removed from his office by the mayor, and shall ever after be incompetent to hold the same.

1946. **Try Cocks — Gauges — Force Pumps.**— It shall be the duty of every owner or other person using steam boilers in the City of Chicago to provide and properly affix to each and every one of such boilers a full complement of try cocks, one water gauge, one steam gauge, one or more safety valves of suitable dimensions (one of which safety valves shall be a spring or pop valve), and plugs of good Banca tin to be inserted in a suitable manner in the flues, crown sheet or other parts of the boiler most exposed to the heat of the furnace when the water

falls below its prescribed limits, all to be subject to the approval of the inspector, and to provide and properly attach to each boiler a good and sufficient force pump or other means of supplying the boiler with water, which shall also be subject to the approval of the inspector.

1947. **Owners to Provide Facilities.**— All owners or other persons using steam boilers and tanks, and other machinery subject to inspection as aforesaid, shall provide, at their own expense, such arrangements and facilities for attaching the instruments for inspection as the inspector shall direct.

1948. **Engineer's Negligence.**— If any engineer shall negligently or wrongfully endanger the life of any person by permitting the water to fall below three inches above the flues or crown sheet of any boiler, or otherwise neglect his duties, he shall be subject to a fine of not less than twenty-five dollars, nor more than two hundred dollars.

1949. **Safety Valve.**— The safety valves of steam boilers shall be loaded to sustain only the maximum pressure allowed by said inspector.

1950. **Penalty.**— Any person who shall violate any of the provisions of this chapter, where no other penalty is provided, shall be subject to a penalty of not less than twenty dollars, nor exceeding one hundred dollars, for each and every offense.

1951. **Monthly Report.**— The inspector of steam boilers of the City of Chicago shall make to the comptroller, on or before the tenth day of each month, a report in writing, verified by affidavit, showing in detail the fees and charges collected by him in the preceding month, and, at the same time, shall pay into the city treasury one-half of such fees and charges so collected by him for the use of the City of Chicago, and one-half of all such fees and charges so collected by him shall be retained by him as and for his salary. A failure to make such report and to pay over such fees and charges, within the time above limited, shall be considered as a resignation of such office, and the mayor may thereupon declare the office vacant and appoint a successor.

1952. **Apparatus.**— The City of Chicago shall provide such instruments, books, papers and things as shall be necessary for the proper performance of the duties of such inspector, which shall be the property of said city, and which shall be delivered by said inspector to his successor in office, or to the commissioner of public works, whenever he shall cease, for any cause, to discharge the duties of said office ; said inspector shall also, without expense or charge, inspect all boilers owned or used by the city, or any of its departments, whenever called upon by the proper officer. He shall also report to the city council every three months, or as often as once a month if required by said council, all inspection of boilers by him made.

N. S. BOUTON, President. E. H. SEDGWICK, Treasurer and General Manager.



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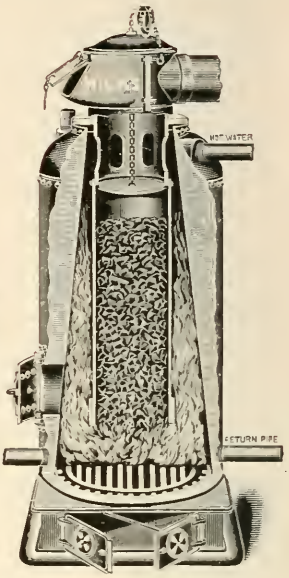
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STEAM AND HOT-WATER HEATING.

So many and intricate are the subjects to be considered in treating upon this branch of the building business, that after most carefully going over data it has been found utterly impossible to do the theme the justice it merits in the space allowed, so that generalities only can be touched upon. It is a question for the architect and the practical steamfitter to advise as to the adoption of one or other of the systems at present in use, as to whether it shall be low-pressure two-pipe or single-pipe steam heating; whether it shall be indirect, or whether it is necessary to use high pressure to carry steam for a long distance, drive machinery, and run elevators, etc., or whether high and low combined will be better, or how far the power fan or blower system or the plenum system should be adopted, as in the case of public halls, churches, etc. Or, again, whether hot-water heating is not more adapted to the requirements of the case. The location of the building must be considered, whether it occupies part of a block or is standing alone; whether it is of frame or brick, and the amount of glass and exposed walls must also enter into the calculation. The chimney, too, is an important factor in the working of a plant. A common rule is to make the flue equal to the area of all the tubes in the boiler. Tredgold's rule for chimneys in inches for a low-pressure engine above 10 horse-power is 112 times the horse-power divided by the square root of the height of the chimney in feet. By horse-power is understood the evaporation of water — a cubic foot of water at 60° evaporated to steam equals one nominal horse-power requiring 70,000 thermal units. Tredgold allows 8 pounds of coal per hour per horse-power, and 300 cubic feet of air for the combustion of each pound. It may be mentioned here that a thermal unit is the amount of heat necessary to raise the temperature of 1 pound of water 1° Fahr. The tendency of architects is to make the chimney flues too small.

In putting in a low-pressure system, either cast-iron or steel boilers may be used and the boiler chosen should never be less than thirty per cent in excess of the heating surface required in the building. As to the manner of arriving at the amount of heating surface opinions vary, and it is well to consult some practical man even after figuring the same. A short method adopted is to obtain the cubical contents in the building and divide the amount by 50. This will give the heating surface required in the ordinary city residence. In addition, consider the coldest corners and make such changes as may seem desirable. The coldest winds are from the west and northwest. For practical purposes the above suggestions may be relied upon in this climate.

There are a number of systems adopted for piping, but the simplest for small jobs is the direct one-pipe gravity return. Radiators should be placed under windows if possible or in exposed parts of the rooms.

In indirect heating, the radiators are placed under the registers, and the cold air is carried from the outside through ducts of wood or metal. This system is undoubtedly the best for the health of the occupants of the building; it takes more fuel, but is absolutely necessary in public buildings.

The direct system is more economical in the using of coal, which will vary from 1½ to 3 tons for every 100 feet of radiation required. This variation is due mainly to the exposure of the building, although the manner of attending to the heater is a large factor in the results obtained. It is more than probable that in the near future vast improvements in the various systems will be brought about, resulting in considerable saving of fuel.

Heating by hot water, although comparatively new, has been used in Chicago some twelve years. A prominent writer, in 1884, remarked that this form of heating in this country has been confined mostly to greenhouses; the same authority goes on to say: "The temperature of the air warmed by hot-water apparatus is

moderate, it being difficult to raise it above 100° Fahr. with the temperature of the hot-water pipes at from 160° to 180° Fahr. It requires also comparatively little attention to secure comfort, since the hot water continues to circulate for some time after the fire is extinguished." (Billings.) The rapid strides made in this branch of heating lead us to arrive at the conclusion that the evenness of the heat evolved, the economy in the use of fuel and the cleanliness of the system have made it as nearly perfect as possible in the heating of residences.

In the heating of residences there are two methods adopted, the one being a compound main, that is, a large pipe taken from the boiler and reduced gradually as it runs to the different radiators, the same principle being adopted with the return, but never reducing the return less than the feed. The other system, which is greatly in use, is the circuit main, that is, one large main extending around the basement to the high point above the boiler, never reducing from the time it leaves till it returns. From this main, pipes are taken off to the radiators, and return into the side of main close to where they were taken out. The placing of radiators should be upon the same plan as for steam work.

In figuring the heating surface for hot water, a large amount should be allowed to the first floor, not forgetting the hall. A hall well taken care of will sometimes save trouble throughout the building.

Indirect radiation is not so much adopted with hot water as with steam, and there is no doubt the extra expense involved will account for this. Twice the amount of surface is used than with direct.

The amount of heating surface is arrived at by the two following methods ; the simpler is one which the writer thinks will never fail, unless the maker of the specifications for the work lacks ordinary judgment : Take the rooms and figure out the cubical contents in the whole building and allow 1 square foot of heating surface to 25 cubic feet of air to be heated ; or, allow 40 square feet of heating surface to 25 cubic feet of air. A small room in all systems will require proportionately more heating surface than a large one. In the inner rooms somewhat less in amount than the exposed rooms should be calculated for, and if indirects are adopted the amount should be doubled. The boiler should be, as with steam, thirty per cent in excess of the amount of radiation, and when the building is much exposed a larger boiler never does harm. It should be remembered that the size of pipe should be large, never sacrificing a job by putting in small. The methods of arriving at the necessary sizes need not be gone into ; suffice it to say that for connection to steam radiators, pipe less than one inch should not be used, nor less than two inches for mains in basements.

In hot-water work, the pipes must be figured in proportion to the amount of water to be heated, rather than the contents of the several mains. In a large plant it is well to calculate the amount of water carried to the length of the boiler it would take to run through to a given point and then proportion the pipes accordingly. By increasing the boiler power it can be ascertained what it will take to heat the whole of the water in the building. If it is desired to heat the water in fifteen minutes, increase the power; in less, decrease it. It is well to get up an equal circulation.

The field of hot-water heating is only just opening up, and new ways of successfully reaching the results desired are constantly presenting themselves, which will bring about a saving in materials, and it is advocated that with lower temperature and plenty of heating surface, hot water used with low pressure can be carried at the boiler and a reduction in the coal bill made appreciable.

FIREPROOF CONSTRUCTION AND PREVENTION OF CORROSION.

BY GEN. WILLIAM SOOY SMITH, MEM. W. S. E.

The use of combustible materials in buildings of all kinds endangers life and property to an extent realized only when we are startled into thinking by some great conflagration or appalling destruction of life by fire.

When a dozen or two of people, unable to escape from a burning building, or two or three firemen nobly battling with the flames, are burned to death, we read a notice of the deplorable event in our daily paper and exclaim, "It is awful," or, "It's too bad," and pass on to the latest news or spicy society gossip and think no more of occurrences which from their very frequency cease to make deep and lasting impressions. But if the great aggregate of destruction of life and property by fire during a single year could be carefully and accurately made up, the world would stand aghast at the horrible revelation.

While such wonderful progress has been made during the latter half of the nineteenth century in the development and applications of physical science, is it not passing strange that so little has been done to mitigate this stupendous evil?

The term "fireproof" is only relative, for there is scarcely anything that will resist the highest known temperatures if applied for a few hours only. And the best and cheapest materials used in buildings do not belong to this class of very refractory substances.

The evil can be mitigated or prevented by the best possible protection that can be given to these by fireproofing, and by preventing the very high temperatures that might otherwise be developed by fires by admitting only the very smallest quantities of more combustible materials, both in the construction of the buildings themselves and in their contents.

Even in the construction of small houses, a cheap wooden frame can be erected and covered, both inside and out, roof and all, with a first-class fireproof plaster that will stand exposure to weather and make dwellings that will be cheap, fireproof, warm in winter and cool in summer, needing no painting, and which will be practically as durable as brick or stone houses.

Larger buildings may be constructed in like manner, and even brick and stone structures may be so plastered and made fireproof, and be otherwise greatly improved.

The subject of buildings is of vital interest to all mankind. Our convenience, comfort, health and safety depend largely upon the character of our dwellings and of the buildings in which our labor is done and our business transacted. It is especially requisite that the materials employed and the modes of construction of buildings shall be such as to make them strong, durable, safe and economical. They should also be as nearly as possible proof against destruction by fire, or by fire and water combined, as they are generally exposed to the joint action of the two in cases of conflagration.

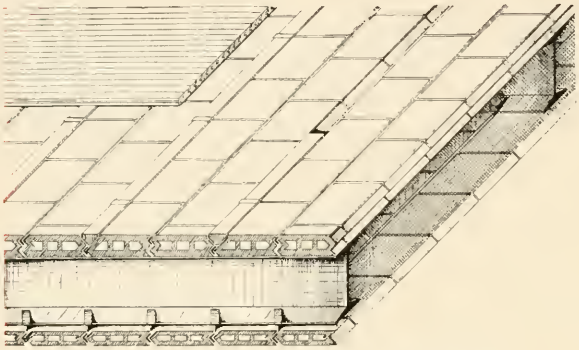
The "skeleton construction" now so common in large cities for tall buildings is about as faulty and objectionable as it can be when exposed to this combined action. The expansion of the steel the buildings contain is at the rate of a tenth of an inch per foot for a change in temperature of one thousand degrees (red heat). The other materials, stone, brick, terra cotta, etc., each has its own rate of expansion differing from each other and from that of steel. They all differ also in their conductivity of heat. If these materials and steel are raised in temperature equally throughout their whole length, the increase in length will differ in each material, and taking the conditions as they occur in almost all burnings of buildings, the steel will, on this account, be heated much more quickly, and throughout

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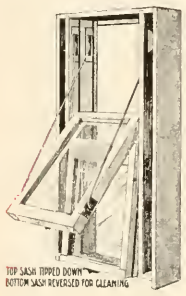
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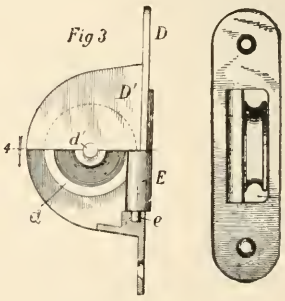
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a much greater part of its length, than any of the other materials present. The differences in the total dimensions of the several parts of the building resulting from these causes is so great as to bring about a destructive war between them. This is not mere theory, although it is correct. Close observation of the effects of fire on buildings discloses the same facts.

When a fire is in progress in a building and its parts heated to a high temperperature, the fire engines throw powerful streams of cold water on the heated materials, and most of those now commonly employed fly to pieces under this joint action of fire and water. So says Chief Swenie, of the Chicago fire department, and all who have become familiar with the effects of fire and water on building material. This is especially true of the light integument of terra cotta built around the steel columns of a skeleton building.

A. W. Smith, an expert tester, having served the writer for the last two years making tests of various so-called fireproofing materials, makes the following report:

CHICAGO, April 5, 1898.

"During the time we were engaged in the effort to discover a perfect fireproofing, I think that nearly, if not quite, every kind used here in the construction of buildings was thoroughly tested and none was perfect; some of them endured fire alone, some endured water, but all save one yielded to fire and water. The clay tile not only transmitted heat too readily, but also when heated to a red heat and subjected to a jet of cold water went to pieces. I found one porous clay tile which withstood the test of red heat and cold water without yielding or cracking. It was a hollow porous tile made by Lehmann & Kohlsaat in the northwestern part of this city. The tile was about two inches thick and eight inches square. It took twenty-five minutes to heat this tile over a very hot flame so that the hand could not be borne on the top. I plastered a tile of this kind on both sides with a three-eighths inch coat of asbestic plaster and the transmission of heat was thereby so greatly retarded that when placed in the same heat for one and one-half hours the bare hand could be borne for a brief time without pain on top of the tile.

"I found one of the compounded fireproof tile, made in this city, to be the best nonconductor of heat I have ever seen. But it will not endure fire alone or fire and water, and is, in my judgment, lacking in strength for many of the purposes of fireproofing. It will literally burn up slowly, though it will not blaze.

"As to these compounded kinds of fireproofing, I believe it to be true that several of them will burn slowly. Some of them will soften nearly to the consistency of pulp even in cold water, and not one of them will endure the application of cold water when they are brought to a red heat.

"Our best results were obtained by plastering the Lehmann & Kohlsaat tile, with a plaster composed chiefly of asbestic.

"The asbestic fireproofing, when used in connection with steel or expanded metal lath, works admirably for the protection of all the members of steel, iron or mill construction, while it is beyond all question unequaled as a wall plaster. The last statement has been frequently demonstrated in eastern cities and here in Chicago. The plaster is strong, practically indestructible by fire, and as a nonconductor of heat is simply wonderful.

"(Signed) A. W. SMITH."

Iron and steel being the strongest materials used in the construction of buildings, and, in proportion to the service to be performed, are the cheapest, have deservedly come to the front rapidly as building materials, particularly in the United States, for the very high buildings that have been erected in the business districts of large cities in which the high prices of lots make it advisable to secure the greatest rentable space practicable on a given area.

The experience previously gained in the construction of iron and steel bridges throughout the world prepared the way for the use of these metals in buildings, and to some extent developed correct methods of proportioning and connecting their

parts. But it seems remarkable, in view of this experience, that such radical defects still creep into the details of iron and steel framing in buildings — such as the flimsy lug and bracket connection of beams and girders with the columns, the eccentricity of loads on the columns, and the want of provision for expansion and contraction of the parts of the skeleton of the building. These defects are easily remedied.

And now supposing that all the metal parts of a building are properly shaped and connected, and all the loads and strains which the skeleton frame is to sustain are amply provided for, two great dangers threatening the safety and durability of the building still remain, namely, the weakening and destruction of the metal members by corrosion or by heat. These dangers are actual and obvious. But the precise rates of weakening by heat, and destruction by corrosion under different circumstances are not as accurately known as they should be.

A column of iron or steel, such as those commonly used in high buildings, would hold little more than its weight when red hot; and it is well known that there is a dangerous weakening effect of heat at much lower temperatures.

Tests made at Watertown, Massachusetts, in 1890, by Mr. James E. Howard, for the author, led to the following conclusions, namely:

"The modulus of elasticity of both iron and steel decreased with an increase in temperature, the change being more marked with mild steels.

"The elastic limit, like the modulus of elasticity, decreases with increased temperature, the rate of change being affected somewhat by the amount of carbon in the steel. With an increase in temperature there is a decrease in tensile strength; the latter in case of mild steels reaches a minimum at about 200° Fahr. With a still further increase in temperature, there is also an increase in tensile strength, but at about 460° Fahr. the tensile strength reaches a maximum. As the temperature rises above this point the tenacity diminishes rapidly."

The following table, compiled from experiments made by R. Luehmann, Hamburg, 1888, is very instructive, showing that the breaking load of a wrought column per square inch of cross-section when red hot is only one-half as great as when the column is cold (normal temperature):

TABLE I.—TESTS OF IRON COLUMNS.

No.	Kind.	Temperature.	Length.	Area of Section.	Load at Rupture.		
					Total.	Per Sq. In.	
				Sq. In.	Lbs.	Lbs.	
1	Cast	Cold	3′ 3⅜″	10.4	430,452	41,390	Opening through column .2″ eccentric.
4	Cast	Hot	6′ 6¾″	10.4	218,000	20,961	Diams. of cyl. 5.9″ and 4.72″.
2	Cast	Hot	3′ 3⅜″	10.4	165,000	15,865	" " " 5.9″ and 4.72″.
6	Cast	Hot	6′ 6¾″	10.4	260,000	25,000	" " " 5.9″ and 4.72″.
7	Cast	Hot	6′ 6¾″	10.4	218,600	21,019	Cyl. filled with P. cement mortar 1 to 1.
8	Cast	Hot	6′ 6¾″	10.4	282,000	27,115	* " " " " " " 1 to 3.
9	Cast	Hot	6′ 6¾″	10.4	231,000	22,211	Coated with P. cement mortar .236″ thick.
14	Cast	Hot	6′ 6¾″	10.4	324,500	31,202	No filling or coating.
15	Cast	Hot	6′ 6¾′	10.4	231,200	22,231	Flat ends. Did not break.
11	Wrought	Cold	6′ 6¾″	10.4	227,000	21,827	
3	Wrought	Hot	3′ 3⅜″	10.4	133,760	12,861	
5	Wrought	Hot	6′ 6¾″	10.4	106,000	10,192	
10	Wrought	Hot	6′ 6¾″	10.4	218,600	21,019	Coated with P. cement mortar .236″ thick.
12	Riveted	Hot	6′ 6¾′	9.8	301,000	30,714	Covered with wood and sheet iron.
16	Riveted	Hot	6′ 6¾″	9.8	172,000	17,551	Flat ends. Not covered.
13	Cast	Hot	6′ 6¾″	10.4	370,000	35,577	Flat ends. Fluted column with capital.

With the exceptions noted, all columns had round-end bearings.
*2″ wrought-iron pipe running through column; pipe filled with mortar.

From this it must be apparent that the usual method of giving to columns, beams and girders certain loads and proportions such as to secure ample strength with a proper factor of safety while the metal is at ordinary atmospheric temperatures, is altogether insufficient to ensure safety in case of exposure to the

high heat that may attack it during a conflagration. And here let it be remembered that the metal while heated loses much of its strength to resist tension and compression, and also loses in greater degree its resistance to lateral flexure, and so the entire skeleton of a building may be deprived of a stiffness necessary to its stability.

It also happens that while the columns, beams and girders are weakened, they are also expanded by heat and unequally, as the degree of heat to which the different members are exposed varies. The unequal expansions of the horizontal beams and girders push the columns out of vertical into buckling positions, rendering almost certain a collapse of the whole structure.

This has already occurred in many instances, and is likely to occur whenever fire attacks a skeleton building in which the metal parts are not absolutely protected by proper fireproofing.

It also frequently occurs that the horizontal expansions of the beams and girders crack and shove out the walls, against which their ends abut.

Many buildings having skeletons of iron and steel imperfectly protected by so-called fireproofing have failed when heated by fire either in these buildings themselves, or in some instances from the burning of an adjacent building even at a considerable distance away, notably in the case of the Manhattan Savings Bank building, corner of Bleecker street and Broadway, New York, which was ignited by the burning of another building forty feet away and practically destroyed, and the three steel skeleton (so-called) fireproof buildings ruined by fire in Pittsburg, Pennsylvania, on May 3, 1897. The story of this fire was summed up in a few lines as follows (*Engineering News*):

"A fire starts in an old type of brick and wood slow-combustion building filled with highly inflammable material, and before its progress can be checked it sweeps over an area of nearly two city squares, destroying property to the amount of $3,000,000. Within this area, besides the first-mentioned buildings, there were three modern fireproofed steel skeleton buildings and half a dozen small shops and dwellings of ordinary brick and wood construction. When the flames had completed their work there remained of two of the fireproof structures only the outer walls and shattered floor arches held together by the steel frame; the third fireproof building had five of its light floors swept nearly clean of their contents, and their dividing walls and partitions injured beyond repair, and the brick and wood shops and dwellings were simply heaps of masonry."

This brief description clearly established the fact that the three "fireproofed steel skeleton buildings" were not fireproof, and indeed it turned out that in one of these fifty per cent of the columns were found, after the fire, stripped of their covering.

Many other instances may be cited, all teaching the same lesson, namely, that while steel at ordinary atmospheric temperatures is the cheapest, strongest and best building material known, it can only be considered safe and durable when thoroughly protected from high heat and corrosion. The rate of corrosion of iron and steel varies greatly under different circumstances. In pure water, containing no free air, with an air-tight covering of paint or imbedded in quicklime, it scarcely corrodes at all, but when in the open air, particularly when alternately wet and dry, it rusts quite rapidly, and when exposed to steam and sulphurous fumes, it is eaten away by corrosion at the rate of one-eighteenth of an inch per annum, as was the case in the floor system of the viaduct in Milwaukee avenue, Chicago, under which locomotives were passing frequently; and corrosion at the same rate occurred in a portion of the western approach of the Eads bridge at St. Louis, where the same circumstances exist.

As the metal in a steel column is usually not more than one-half inch thick, corrosion at the above rate would make a steel building unsafe in less than twenty years.

In an iron or steel skeleton building the columns starting at the basement floor, or at the floor at street level, extend to the top of the building. They are

hollow and painted only on the outside, and this with paint that is so perishable that it will afford no protection from corrosion after the first five or ten years. The girders are nearly as much exposed as the columns, while the beams are generally bare on the top and bottom surfaces of the flanges, and sometimes over a considerable part of the webs.

Wherever the surfaces inside or outside are left uncovered they are exposed to corrosion that will be more or less rapid according to the temperature and hygrometric conditions of the air surrounding them. And in many instances, particularly in factories, there are destructive elements in the atmosphere, such as sulphur and chlorine, which may cause rapid wasting away of the metal, and which are the more dangerous, as they are apt to escape notice.

A steel or iron skeleton building can be made safe and durable only by thorough knowledge of the nature of these metals and careful provision against the dangers that threaten it under all the conditions of their use.

Supposing that the structural details are correct, care must next be taken to prevent corrosion. This may be done by covering all metallic surfaces, both inside and outside, with an indestructible coating of a material that will absolutely prevent corrosion.

This having been done, all the metal parts must be inclosed in a fireproof and fireproofing material that will not only resist the heat of a conflagration, but so shield the metal from attack by heat as to prevent any considerable changes of its temperature. And this may be best and most certainly accomplished by having an eye to the fireproofing of each individual member.

Slow combustion of buildings can be secured by carefully whitewashing the inside and outside with fireproof material laid on with a brush. And fire departments claim that they can extinguish almost any fire if it is only prevented from spreading too much until they can bring their engines into play.

It is of the utmost advantage to protect each building from the danger of ignition in the case of the burning of its neighbors, and this can be at least measurably done by the whitewashing suggested, and by putting fireproof shutters on all windows and openings of every kind. Where there is an open court in a building some sort of fireproof covering should be put upon all parts of such court, and the same protection should be given to stairways and elevator shafts.

These dangers and the necessity of protection from them are ably presented in a paper on "Fireproof Construction," written by Mr. Purdy, civil engineer, and published in the proceedings of the American Society of Civil Engineers, September, 1897.

The essential characteristics of a fireproofing material for buildings are:

1. It must itself be incombustible.
2. It must be as nearly as possible a nonconductor of heat.
3. It must be strong and durable.

While there are very many so-called fireproofing materials in use for which these qualities are claimed, up to a very recent period there was not one of them that was a good nonconductor of heat, that would stand heating to redness, and being plunged into cold water while red hot without flying to pieces.

Within a few months, after years of careful experimenting, and testing the material, "asbestic" was discovered, which possesses all the requisites above enumerated, as proven by severe tests on a large scale at Montreal, New York, Washington and Chicago.

The requirements of a building are that it shall be strong enough to carry all its loads and resist wind pressure and all other strains to which it may be subjected as a whole or in any of its parts. That it shall be as nearly as possible fire and weather proof, and that it shall be durable and not unreasonably costly.

Supposing that steel is used for the framework of the structure as being preferable to any other for the frames of large buildings, and that proper shapes and sizes of all parts of such frames have been carefully and correctly determined, and the disposition and connections of these parts have been properly made, it

only remains to cover the skeleton of a building inside and outside, roof included, with an integument that shall be fireproof, strong and durable, and, if possible, light, tough and elastic and a good nonconductor of heat and impervious to air or water. Such covering can be made of fireproof plaster of any necessary or desirable thickness, and suitable cornices and moldings can be worked out of the same material.

As soon as the skeleton is erected every part of it should be covered with a thick coat of the fireproof material laid on with a brush.

The metal lathing should then be put on, strengthened where necessary by angle or tee iron covering all parts of the frame and leaving an air space between the lathing and every part of the frame.

A form of metal lath of trough shape and projecting ledges on the plastering side permitting the plaster to go through an open key-hole back to a double retainer on each side of the trough, and with a practically continuous key or clinch, has been brought out by Mr. G. A. Turnbull, which, secured to the skeleton frame of a building, will receive the plaster and hold it admirably while adding also greatly to the strength and stiffness of the frame. Strong floors and ceilings can be made by the use of this same form of lath and rough flooring.

The great weight of tile, brick and stone now used would thus be dispensed with and the much lighter construction described substituted. A very great saving of weight in the frame itself would be effected and the cost of the necessary foundations of the buildings be greatly reduced.

There would be so many other important advantages realized that we need not describe them here.

Enough has been said to invite the careful and unprejudiced study and criticism of engineers and architects, and out of this kind of investigation there may come a new system of building that may be the ideal one of the future.

MECHANIC'S LIEN LAW.

An Act to Revise the Law in Relation to Mechanics' Liens.

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SEC. 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That any person who shall by any contract with the owner of a lot or tract of land, or with one whom such owner has authorized or knowingly permitted to improve the same, furnish or specially manufacture and prepare materials, fixtures, apparatus or machinery for the purpose of, or in building, altering, repairing or ornamenting any house or other building, walk, driveway, fence or improvement, or appurtenance thereto on such lot, or connected therewith, and upon, over or under a sidewalk, street or alley adjoining; or fill or excavate such lot; or raise or lower any house thereon, or remove any house thereto, or perform services as an architect for any such purpose; or furnish or perform labor or services as superintendent, timekeeper, or otherwise in building, altering, repairing, or ornamenting the same; or furnish materials, fixtures, apparatus, machinery, labor or services on the order of his agent, architect or superintendent having charge of the improvement in building, altering, repairing or ornamenting the same, shall be known under this act as a contractor, and shall have lien upon the whole of such tract of land or lot and upon the adjoining or adjacent lots of such owner constituting the same premises and occupied or used in connection with such lot as a place of residence or business; and, in case the contract be entire and relate to two or more buildings on adjoining or adjacent lots of the same owner, upon all of said lots and the improvements thereon, for the amount due to him for such material, fixtures, apparatus, machinery, services or labor, and interest from the date the same is due.

This lien shall extend to an estate in fee, for life, for years, or any other estate, or any right of redemption, or other interest which such owner may have in the lot or land at the time of making such contract or may subsequently acquire therein; and, as to the improvements for which the lien is claimed, shall be superior to any right of dower of husband or wife in such improvements.

This lien shall attach as of the date of the contract, but as against or to the prejudice of any other creditor, incumbrancer or purchaser, without actual or

constructive notice of such contract, the lien shall not attach as of the date of the contract, unless, within thirty days thereafter, the contractor shall file in the office of the clerk of the Circuit Court of the county in which such improvement is to be made a statement, giving his name and the name of the owner of the property, what his contract is for, the amount to be paid, a description of the property, and the date when delivery of material or work is to be completed. If such statement is not filed within the thirty days named, the lien shall attach from the date the same is filed ; provided, that commencement of work or delivery of material at the premises by any contractor shall serve the same purpose as the filing of such statement or commencement of work by all parties who may subsequently furnish or especially prepare material for, or perform services or labor in the construction of, the improvement.

The lien for materials bought, specially prepared for, or delivered at, but not used in the improvement, shall be second to the lien of contractors whose material was used therein ; and as against purchasers and incumbrancers of such real estate, who become such without actual or constructive notice of the contract for materials, the lien shall prevail, only to the extent of the value of the materials used.

If the materials, fixtures, apparatus, machinery, labor or services were furnished under a contract with any of the persons named other than the owner, or one by him authorized to make such contract, the owner may prevent such lien for what is not then furnished or performed by giving written notice to the person furnishing or performing the same that he will not be responsible therefor.

SEC. 2. Any person furnishing services, labor or material for the erection of a new building, or structure or improvement, but by mistake upon land owned by another than the party contracting as owner, shall have a lien for such services, labor or material upon such building, or structure or improvement ; and the court in the enforcement of such lien shall order and direct such building, structure or improvement to be separately sold under its decree, and the purchaser may remove the same within such reasonable time as the court may fix.

SEC. 3. If any such services or labor are performed upon, or materials are furnished for, lands belonging to any married woman, with her knowledge and consent, in pursuance of a contract with the husband of such married woman, the person furnishing such labor or materials shall have a lien upon such property, the same as if such contract had been made with such married woman ; and in case the title to such lands upon which improvements are made is held by husband and wife jointly or by entireties, the lien given by this act shall attach to such lands and improvements, if the improvements be made in pursuance of a contract with both of them, or in pursuance of a contract with one of them, by and with the knowledge and consent of the other ; and, in all such cases, no claim of homestead right set up by a husband or wife shall defeat the lien given by this act.

SEC. 4. When the owner of the land shall have failed to perform his part of the contract by failing to pay to the contractor moneys justly due him under the contract at the time when the same should have been paid, or has failed to perform his part of the contract in any other manner, the contractor shall not be held liable for any delay on his part during the period of, or caused by, such breach of contract on the part of the owner ; and if, after ten days' notice in writing by the contractor, the owner shall fail to comply with his contract, the contractor may discontinue the work, and in such case he shall be entitled to a reasonable compensation for as much thereof as has been performed in proportion to the price stipulated for the whole, and such damages as the contractor may have sustained by reason of the owner's default, and the court shall adjust his claim and allow him a lien accordingly. In such case the party selling material which has not been used shall have the right to take possession of and remove the same if he so elects.

SEC. 5. Within ten days after the contract is made, and before commencing work thereunder, it shall be the duty of the contractor to give the owner, and also

the duty of the owner to require of him, a statement in writing, under oath or verified by affidavit, of the names and addresses of all parties having sub-contracts for specific portions of the work, or for material, and of the amount to become due each, and when; or if any such sub-contracts are not then let, the names and addresses of those who have made bids and proposals for the same or for material, and the respective amounts of such bids or proposals, and, within ten days after the same are accepted, the amount thereof; and if any contractor shall fail to so notify the owner within five days after written notice to do so, such owner may cancel the contract with such contractor by written notice of such cancellation, and the lien of such contractor shall be subject to the liens of all other creditors. But this section shall not apply to contractors who have given, or within the ten days first named shall give, to the owner a good and sufficient bond for the completion of such building or improvement free and clear of all mechanics' liens; and such bond is made for the use and benefit of those who may be entitled to such liens; nor where such persons shall in advance waive their rights to liens and bind themselves to perform their respective sub-contracts, services or labor; nor to contractors whose sub-contractors and material men agree to take solely for payment; nor to merchants and dealers in material only.

SEC. 6. If the work is done or materials are furnished under a verbal contract, no lien shall be had by virtue of this act, unless the work shall be done or materials furnished within one year from the date of the contract, and final payment therefor is to be made within such time.

If the contract be written, no lien shall be had by virtue of this act, if the time stipulated for the completion of the work or furnishing materials is beyond three years from the date of the contract, or the time of payment beyond one year from the time stipulated for the completion thereof. Nor shall a lien be had under a written contract where the time of completion or final payment is more than one year from the date of the contract, unless either the work be continual up to the date for such payment, or within thirty days after completion the contractor shall file in the office of the clerk of the Circuit Court of the county where the improvement is made, a statement under oath, or verified by affidavit, giving the name of the contractor and of the person contracting with him, a description of the property improved, the balance due, and the date for the final payment, which statement shall have the effect and stand in lieu of the claim for lien hereinafter provided for.

SEC. 7. No contractor shall be allowed to enforce such lien as against or to the prejudice of any other creditor or incumbrancer or purchaser, unless, within four months after the last payment shall have become due and payable according to the terms of the original contract, he shall either bring suit to enforce his lien therefor, or shall file with the clerk of the Circuit Court of the county in which the building, erection or other improvement to be charged with the lien is situated, a claim for lien against the owner, verified by the affidavit of himself, agent or employe, which shall consist of a brief statement of the contract, the date the same was made, the date fixed therein, or the time implied, for completion and for final payment, and the date that the same was completed, if completed, the balance due after allowing all credits, and a sufficiently correct description of the lot, lots or tract of land to pass the title thereof by deed of conveyance. An itemized account shall not be necessary, except for extras, where the contract is for all of the work or materials, or all of a specific part thereof at a fixed and agreed price. Such claim for lien may be filed at any time after the contract is made, and, as to the owner, may be amended at any time before trial or on the hearing of a suit to enforce the lien, subject to a continuance, on account of such amendment, in the discretion of the court. No such lien shall be defeated to the proper amount thereof because of an error or overcharge on the part of any person claiming a lien therefor under this act, unless it shall be shown that such error or overcharge was made with intent to defraud. Nor shall any such lien for material be defeated because of lack of proof that the material, after the delivery thereof, actually entered into the construction of such

building or improvement, provided it is shown that such material was in fact in good faith delivered at the place where said building or improvement was being constructed, for the purpose of being used in such construction. *And, provided further*, that in the case of the construction of a number of buildings under contract between the same parties, it shall be sufficient, in order to establish such lien for material, if it be shown that such material was in good faith delivered at any one of the said buildings for the purpose of being used in the construction of any one or all of such buildings ; and such lien for such material shall attach to all of said buildings, together with the land upon which the same are being constructed, the same as in a single building or improvement.

SEC. 8. All liens or claims for liens which may arise or accrue under the terms of this act shall be assignable, and proceedings to enforce such liens may be maintained by and in the name of the assignee, who shall have as full and ample power to enforce the same as if such proceedings were taken under the provisions of this act by and in the name of the lien claimant.

SEC. 9. If payment shall not be made to the contractor having a lien, by virtue of this act, of the amount due when the same becomes due, then such contractor may bring suit to enforce his lien by bill or petition in any court of competent chancery jurisdiction in the county where the labor was done or the materials delivered.

Any two or more persons having liens on the same property may join in bringing such suit, setting forth their respective rights in their bill or petition. If a suit be then pending to foreclose a mortgage or trust deed, or to enforce a mechanic's lien on the premises, or any such suit shall afterward be instituted, all lien claimants not made parties thereto, and having actual notice of such proceeding, and all defendant lien claimants shall file their suits to enforce their liens by answer to the bill or petition in the nature of an intervening petition; and the same shall be taken as cross-bills against all the parties to such suit; and the said bill or petition shall not thereafter be dismissed as to any such lien claimant, or as to the owner or owners of the premises, without the consent of such lien claimant. The claimant or petitioner and all defendants to such bill or petition may contest each other's rights without any formal issue of record made up between them other than that upon the original bill or petition, as well with respect to the amount due as to the right to the benefit of the lien claimed; provided, that if by such contest by co-defendants any lien claimants be taken by surprise, the court may, in its discretion, as to such claim grant a continuance.

The court may render judgment against any party summoned and failing to appear, as in other cases of default. Such suit shall be commenced or answer filed within two years after final payment is due according to the terms of the original contract, or the lien shall be void as to all parties.

SEC. 10. Suits may be instituted under the provisions of this act in favor of administrators or executors, and may be maintained against the representatives in interest of those against whom the cause of action accrued ; and in suits instituted under the provisions of this act the representatives of any party who may die pending the suit shall be made parties.

SEC. 11. The bill or petition shall contain a brief statement of the contract or contracts on which it is founded ; the dates when made, to be completed for final payment and when completed ; if not completed, why ; what was done, and between what dates; it shall also set forth the amount due and unpaid, a description of the premises which are subject to the lien, and such other facts as may be necessary to a full understanding of the rights of the parties. Where plans or specifications are by reference made a part of the contract, it shall not be necessary to set the same out in the pleadings or as exhibits, but the same may be produced on the trial of the suit.

The complainant or petitioner shall make all parties interested, of whose interest he is notified or knows, parties defendant, except his own sub-contractors, and promptly place a summons for such parties in the hands of the proper officer for

service, which summons shall issue and service thereof be had as in suits in chancery; and when any defendant resides or has gone out of the State, or on due inquiry cannot be found, or is concealed within this State, so that process cannot be served on him, the complainant or petitioner shall cause notice to be given to him in like manner and upon the same conditions as is provided in suits in chancery, and his failure to so act with regard to summons or notice shall be ground for judgment or decree against him as upon the merits. The same rule shall prevail with cross-petitioners with regard to any persons of whose interests they have knowledge, and who are not already parties to the suit or action, and the court may, in its discretion, enter like judgment or decree against any complainant before it not diligently prosecuting his claim to final judgment. Parties in interest, within the meaning of this act, shall include persons entitled to liens thereunder whose claims are not, as well as are, due at the time of the commencement of suit; and such claims shall be allowed, subject to a reduction of interest, from the date of judgment to the time the claim is due; also all persons who may have any legal or equitable claim to the whole or any part of the premises upon which a lien may be attempted to be enforced under the provisions thereof, or who are interested in the subject-matter of the suit. Any such persons may, on application to the court wherein the suit is pending, be made or become parties at any time before final judgment. No action or suit under the provisions of this act shall be voluntarily dismissed by the party bringing the same without due notice to all parties before the court and leave of court upon good cause shown and upon terms named by the court.

SEC. 12. For the purpose of bringing all parties in interest before the court, the court shall permit amendments to any part of the pleadings, and may issue process, make all orders requiring parties to appear, and requiring notice to be given, that are or may be authorized in proceedings in chancery; and shall have the same power and jurisdiction of the parties and subject; and the rules of practice and proceedings in such cases shall be the same as in other cases in chancery, except as is otherwise provided in this act. The court shall have power to appoint receivers for property on which liens are sought to be enforced in the same manner, for the same causes and for the same purposes as in cases of foreclosure of mortgages, as well as to complete any incompleted building, where the same is deemed to be to the best interest of all the parties interested.

SEC. 13. Defendants shall answer the bill or petition under oath, unless the oath is waived by the complainant or petitioner, and the plaintiff shall except or reply to the answer as though the proceeding was in chancery. The answer shall be regarded as the plea of the defendant, and by replication thereto an issue, or issues, shall be formed, which shall be tried by the court, or by a jury under the direction of the court, as the court may direct or the parties agree. The owner shall be entitled to make any defense by way of set-off, recoupment or counterclaim that he could in any action at law, and shall be entitled to the same right of recovery on proof of such in excess of the claim of the contractor, or any other party to the suit, but for matters not growing out of the contract such recovery shall be without prejudice to the rights of the sub-contractors thereunder for payment out of the contract price or fund.

SEC. 14. In no case shall the want of preparation for trial of one claim delay the trial in respect to others, but trial shall be had upon issues between such parties as are prepared, without reference to issues between other parties; and when one creditor shall have obtained a decree or judgment for the amount due, the court may order a sale of the premises on which the lien operates, or a part thereof so as to satisfy the decree or judgment; provided, that the court may, for good cause shown, delay making any order for sale or distribution until the rights of all parties in interest are ascertained and settled by the court.

SEC. 15. Upon all questions arising between different contractors having liens under this act, no preference shall be given to him whose contract was first made; but the claim of any such person for mechanical or other labor by him

personally performed, to the extent of two weeks' wages, shall be a preferred lien to an amount equal to ten per cent of the proportionate value or the entire work completed up to the date of the last day's work of such laborer.

SEC. 16. No incumbrance upon land, created before or after the making of the contract under the provisions of this act, shall operate upon the building erected, or materials, fixtures, apparatus or machinery furnished for erecting or improving the same, until the lien in favor of the person doing the work or furnishing the materials, fixtures, apparatus or machinery shall have been satisfied; and upon questions arising between different incumbrances and lien creditors, the previous incumbrance shall be preferred to the extent of the value of the land at the time of making the contract, the lien creditors to the extent of the market value the same is enhanced by reason of the improvements; and the court shall ascertain, by jury or otherwise, as the case may require, what proportion of the proceeds of the sale shall be paid to the several parties in interest.

Where, after a trust deed or mortgage has been recorded, contracts shall be made for the improvement of the property, and the owner shall pay for labor or material in such improvement, the enhanced value thereby given shall be treated as a fund in which the mortgagee and lien holder shall participate *pro rata*.

Any incumbrance, whether by mortgage, judgment or otherwise, charged and shown to be fraudulent in respect to creditors may be set aside by the court, and the premises made subject to the claim of the complainant or petitioner, freed and discharged from such fraudulent incumbrance.

SEC. 17. Where the contract for material or labor is entire and relates to houses on different lots, the court shall apportion the amount of the lien and cost on each house and lot according to the value thereof, and direct the sale of each house and lot separately to satisfy the amount of the lien and costs apportioned against it; and if the same shall not sell for sufficient to pay such amount, shall order the deficiency paid out of the surplus proceeds of the sale of any other of said houses and lots covered by such lien.

SEC. 18. The costs of proceedings, as between all parties to the suit, shall be taxed equitably against the losing parties, and where taxed against more than one party, shall be so taxed against all in favor of the proper party, but equitably as between themselves; and the costs, as between creditors aforesaid in contests relative to each other's claims, shall be subject to the order of the court, and the same rule shall prevail in respect to costs growing out of the proceedings against and between incumbrances. In all cases where liens are enforced, a fee of five dollars shall be taxed for filing the claim for lien, and the court shall, in its discretion, order a reasonable attorney's fee, not exceeding ten per cent, taxed as a part of the costs in favor of the claimant, and where the same are defeated, in favor of the owner.

SEC. 19. Whatever right or estate such owner had in the land at the time of making the contract may be sold in the same manner as other sales of real estate are made under decrees in chancery. If any part of the premises can be separated from the residue, and sold without damage to the whole, and if the value thereof is sufficient to satisfy all the claims proved in the cause, the court may order a sale of that part.

SEC. 20. The court shall ascertain the amount due each lien creditor, and shall direct the application of the proceeds of sale to be made to each in proportion to their several amounts, according to the provisions of this act; except that in the payment of mechanic's lien claims, the claims of laborers, who are contractors under this act, to the extent of two weeks' wages, shall be first paid; after that the balance due such laborers and other mechanic's lien creditors *pro rata*.

If, upon making sale under this act of any or all premises, the proceeds of such sale shall not be sufficient to pay the claims of all parties, according to their rights, the decree shall be credited by the amount of said sale, and execution may issue in favor of any creditor whose claim is not satisfied for the balance

due, as upon a deficiency decree in the foreclosure of a mortgage in chancery; and such deficiency decree shall be a lien upon all real estate and other property of the party against whom it is entered to the same extent and under the same limitations as a judgment at law; and in case of excess of sales over the amount of the decree, such excess shall be paid to the owner of the land, or to the person who may be entitled to the same, under the direction of the court.

SEC. 21. Upon all sales under this act, the right of redemption shall exist in favor of the same persons, and may be made in the same manner as is or may be provided for redemption of real estate from sales under judgments and executions at law.

SEC. 22. Every mechanic, workman or other person who shall in pursuance of the purposes of the original contract furnish to or specially manufacture and prepare any materials, apparatus, machinery or fixtures, or furnish or perform services or labor for the contractor, shall be known under this act as a sub-contractor, and shall have a lien for the value thereof, with interest on such amount from the date the same is due, in the same manner, from the same time, on the same property and to the same extent as is herein provided for the contractor, and also as against the creditors of the contractor, on the materials, fixtures, apparatus or machinery furnished, and on the money or other consideration due or to become due from the owner under the original contract. But the aggregate of all the liens hereby authorized shall not exceed the price stipulated in the original contract between such owner and the contractor for such improvements, except as hereafter provided. In no case, except as hereinafter provided, shall the owner be compelled to pay a greater sum for or on account of such house, building or other improvements than the price or sum stipulated in said original contract or agreement, unless payment be made to the contractor, or to his order, in violation of the rights and interest of the persons intended to be benefited by this act: *Provided*, if it shall appear to the court that the owner and contractor fraudulently, and for the purpose of defrauding sub-contractors, fixed an unreasonably low price in their original contract for the erection or repairing of such building, then the court shall ascertain how much of a difference exists between a fair price for labor and material used in said building or other improvements and the sum named in said original contract, and said difference shall be considered a part of the contract and be subject to a lien; but in no case shall the contractor's time or profits be secured by this lien, only so far as the sum named in the original contract or agreement.

But where the contractor's statement, made as provided in Section five (5), shows the amount to be paid to the sub-contractor, or party furnishing material; or the sub-contractor's statement, made pursuant to Section twenty-three (23) shows the amount to become due for material, or notice is given to the owner, as provided in Sections twenty-five (25) and twenty-six (26), and thereafter such sub-contract shall be performed, or material to the value of the amount named in such statements or notice shall be prepared for use and delivery, or delivered, without written protest on the part of the owner previous to such performance or delivery, or preparation for delivery, then, and in any of such cases, such sub-contractor or party furnishing or preparing material, regardless of the price named in the original contract, shall have a lien therefor to the extent of the amount named in such statements or notice. Also, in such cases, and in case of like default by the contractor, the sub-contractor or party furnishing or preparing material shall have and may enforce his lien to the same extent and in the same manner that the contractor may under conditions that arise as provided for in Section 4 of this act, and shall have and may exercise the same rights as are therein provided for the contractor.

And when the contractor shall have failed to perform and abandoned his part of the contract, the sub-contractors and material men, or any of them, shall have the right to complete the same, and shall be entitled to a reasonable compensation

thereof, in proportion to the price stipulated for the whole, and the court shall adjust their claims accordingly.

SEC. 23. Whenever, after a contract has been made, the contractor shall associate one or more persons as partners, or joint contractors, in carrying out the same, or any part thereof, the lien for materials or labor furnished by a sub-contractor to such contractor and his partners or associates, as originally agreed upon, shall continue the same as if the sub-contract had been made with all of the said parties.

When the contractor shall sublet his contract, or a specific portion thereof, to a sub-contractor, the party furnishing material to or performing labor for such sub-contractor shall have a lien therefor to the extent of the sum to be paid to the sub-contractor who purchases material from or employs him, and may enforce his lien in the same manner as is herein provided for the enforcement of liens by sub-contractors.

Any sub-contractor shall, as often as requested in writing by the owner or contractor, or the agent of either, make out and give to such owner, contractor or agent a statement of the persons furnishing material, giving their names and how much, if anything, is due or to become due to each of them, and when the same became or will become due, which statement shall be made under oath if required. If any sub-contractor shall fail to furnish such statement within five (5) days after such demand, he shall forfeit to such owner or contractor the sum of fifty dollars ($50) for every offense, which may be recovered in an action of debt before a justice of the peace, and shall have no right of action against either owner or contractor until he shall furnish such statement, and the lien of such sub-contractor shall be subject to the liens of all other creditors.

SEC. 24. Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor for a public improvement in this State shall have a lien on the money, bonds or warrants due or to become due such contractor for such improvement: *Provided*, such person shall, before any payment or delivery thereof is made to such contractor, notify the officials of the State, county, township, city or municipality, whose duty it is to pay such contractor, of his claim by a written notice and the full particulars thereof. It shall be the duty of such official so notified to withhold a sufficient amount to pay such claim until it is admitted, or by law established, and thereupon to pay the amount thereof to such person, and such payment shall be a credit on the contract price to be paid to such contractor.

Any officer violating the duty hereby imposed upon him shall be liable on his official bond to the person serving such notice for the damages resulting from such violation, which may be recovered in an action at law in any court of competent jurisdiction. There shall be no preference between the persons serving such notice, but all shall be paid *pro rata* in proportion to the amount due under their respective contracts.

SEC. 25. Such sub-contractor, or party furnishing materials, may at any time after making his contract with the contractor, and shall within sixty (60) days after the completion thereof, or, if extra work is done or extra material is delivered thereafter, within sixty days after the date of completion of such extra work or final delivery of such extra material, cause a written notice of his claim, or of such sub-contract, with a copy thereof, if the same be in writing, and the amount due or to become due thereunder, and when it became or will become due, to be personally served on the owner or his agent, or the architect or superintendent having charge of the building or improvement; and his claim shall be a lien as against the owner from the date of the service of such notice, so far as the owner may be indebted to the contractor at that time, or may become indebted to him as such contractor thereafter. Where such written contract by reference makes the plans and specifications of the original contract part thereof, it shall not be necessary to serve a copy of such plans and specifications with the notice. It shall be the duty of the agent, architect or superintendent so notified to at once transmit

such notice to the owner; and for his failure so to do he shall be personally liable, both to the owner and party serving such notice, for all damages in consequence of such failure, which may be recovered in an action at law in any court of competent jurisdiction.

Provided, such notice shall not be necessary where the sworn statement of the contractor or sub-contractor provided for herein shall serve to give the owner true notice of the amount due and to whom due; but where such statement is incorrect as to the amount, the sub-contractor or material man named shall be protected to the extent of the amount named therein as due or to become due to him.

The form of such notice may be as follows:

To (name of owner). You are hereby notified that I have been employed by (name of contractor) to (state here what was the contract, or what was done, or to be done, or what the claim is for) under his contract with you, on your property at (here give substantial description of the property), and that there was due me on the.....day of..... or is to become due on the.....day of.....(as the case may be) therefor the sum of.....dollars.

Dated at.....this.....day of.....A. D. 189..

(Signature).....

SEC. 26. In all cases where the owner, agent, architect or superintendent cannot be found in the county in which said improvement is made, or shall not reside therein, the sub-contractor or person furnishing materials, fixtures, apparatus, machinery, labor or services shall give notice by filing in the office of the clerk of the Circuit Court against the person making the contract and the owner a claim for lien, verified by the affidavit of himself, agent or employe, which shall consist of a brief statement of his contract or demand, what he is to do, within what time, when and what amount he is to be paid therefor; or, if done, what done, between what dates, and the balance due after allowing all credits, and the character thereof, and when the same became due, and a substantially correct description of the lot, lots, or tract of land. An itemized account shall not be necessary, except for extras, where the sub-contract is for all of a specific part of the work, or for all of the materials of a certain class, where the amount to be paid therefor was a fixed and agreed sum.

SEC. 27. The claim of any person for mechanical or other labor, under Section twenty-two (22) of this act, to the extent of two weeks' wages, shall be a preferred lien for twenty days from the last day's work performed by such person, to an amount equal to ten per cent of the proportionate value of the contract completed up to the date of said last day's work: *Provided*, such notice is served within twenty days from the day when such last day's work was performed by such person: and the owner or his agent may retain for said twenty days such ten per cent out of any money due or to become due to the contractor: *And provided further*, this ten per cent shall not be construed as in addition to any per cent that may be held back in pursuance of the terms of the contract between the owner and contractor.

SEC. 28. When the owner or his agent is notified, as provided in this act, he shall retain from any money due or to become due the contractor an amount sufficient to pay all demands that are or will become due such sub-contractor, tradesman, material man, mechanic or workman of whose claim he is notified, and shall pay over the same to the persons entitled thereto as the same becomes due.

Such payments shall be as follows:

First—All claims for mechanical or other labor to the extent of two weeks' wages, of which notice has been served as provided in the preceding section, shall be paid in full. If the money due and to become due the contractor, including the ten per cent in said section provided, is not sufficient to pay such claims in

full, he shall pay them *pro rata*, in proportion to the amounts thereof, respectively, at the time of such payment.

Second—The claims of the laborers above named for the balance due in excess of two weeks' wages, and of other laborers, tradesmen, material men and sub-contractors, who are entitled to liens, *pro rata*, in proportion to the amount due them, respectively.

All payments made as directed shall, as between such owner and contractor, be considered the same as if paid to such contractor.

Any payment made by the owner to the contractor after such notice, without retaining sufficient money to pay such claims, shall be considered illegal, and made in violation of the rights of the sub-contractors, and the rights of such sub-contractors to a lien shall not be affected thereby ; but the owner shall not be held liable to any sub-contractor, or other person whose name is omitted from the statement provided for in Section five (5) of this act, nor for any larger amount than the sum therein named as due such person (provided such omission is not made with the knowledge or collusion of the owner), unless previous thereto or to his payment to his contractor he shall be notified as herein provided by such persons of their claim, and the true amount thereof.

Third—The balance, if any, to the contractor.

SEC. 29. If the money due to the sub-contractor shall not be paid within ten days after his notice is served, as provided in Sections twenty-five (25) and twenty-seven (27), or within ten days after his claim for lien is filed, as provided in Section twenty-six (26), or on the date the same is shown to be due by the contractor's statement made, as provided in Section five (5), and any money shall then be due from such owner to the contractor, then such person may either file his petition and enforce his lien as heretofore provided for the contractor in Sections nine (9) to twenty-one (21) inclusive, of this act, except as to the time within which suit shall be brought, or he may sue the owner or contractor jointly for the amount due him in any court having jurisdiction of the amount claimed to be due, and a personal judgment may be rendered therein, as in other cases.

In such actions at law, as in suits to enforce the lien, the owner shall be liable to the complainant for no more than the *pro rata* share that such person would be entitled to with other sub-contractors out of the funds due to the contractor from the owner under the contract between them ; and such actions at law shall be maintained against the owner only in case the complainant establishes his right to the lien. All suits and actions by sub-contractors shall be against both contractor and owner, jointly, and no decree or judgment shall be rendered therein until both are duly brought before the court by process or publication. All such judgments, where the lien is established, shall be against both jointly, but shall be enforced against the owner only to the extent that he is liable under his contract, as by this act provided, and shall recite the date from which the lien thereof attached, according to the provisions of Sections one (1) and twenty-two (22) of this act ; but this shall not preclude a judgment against the contractor, personally, where the lien is defeated.

SEC. 30. If the execution issued on a judgment obtained before a justice of the peace shall be returned not satisfied, a transcript of such judgment may be taken to the Circuit Court and spread upon the records thereof, and execution issue thereon as in other cases, except that the lien of the same shall be preserved as a preferred lien on the property improved from the date recited in the judgment, and enforced thereon the same as if a decree had been rendered by the Circuit Court in a suit to enforce such lien under the provisions of this act.

SEC. 31. If there are several liens under Section twenty-two (22) upon the same premises, and the owner or any person having such a lien shall fear that there is not a sufficient amount coming to the contractors to pay all of such liens, such owner or any one or more persons having such lien may file his or their sworn bill or petition in the Circuit Court of the proper county, stating such fact, and such other facts as may be sufficient to a full understanding of the rights of

the parties. The contractor and all persons having liens upon, or who are interested in the premises, so far as the same are known to or can be ascertained by the claimant, or petitioner, upon diligent inquiry, shall be made parties. Upon the hearing the court shall find the amount coming from the owner to the contractor, and the amount due to each of the persons having liens; and in case the amount found to be coming to the contractor shall be insufficient to discharge all liens in full, the amount so found in favor of the contractor shall be divided between the persons entitled to such liens *pro rata*, in proportion to the amount so found to be due them respectively. If the amount so found to be coming to the contractor shall be sufficient to pay the liens in full, the same shall be so ordered. The premises may be sold as in other cases under this act. The parties to such suit shall prosecute the same under like requirements as are directed in Section eleven (11) of this act, and all persons who shall be duly notified of such proceedings, and who shall fail to prove their claims, whether the same be in judgment against the owner or not, shall forever lose the benefit of and be precluded from their liens and all claims against the owner.

Upon the filing of such bill or petition, the court may, on the motion of any person interested, and shall, upon final decree, stay further proceedings upon any judgment against the owner on account of such liens.

SEC. 32. Should the contractor, for any cause, fail to complete his contract, any person entitled to a lien as aforesaid may file his petition in any court of record against the owner and contractor, setting forth the nature of his claim, the amount due, as near as may be, and the names of the parties employed on such house or other improvement subject to liens; and a notice of such suit shall be served on the persons therein named; and such as shall appear shall have their claims adjudicated, and decree shall be entered against the owner and contractor for so much as the work and materials shall be shown to be reasonably worth, according to the original contract price, first deducting so much as shall have been rightly paid on said original contract by the owner, and damages, if any, that may be occasioned the owner by reason of the non-fulfillment of the original contract; the balance to be divided between such claimants in proportion to their respective interests, to be ascertained by the court. The premises may be sold, as in other cases under this act. The parties to such suit shall prosecute the same under like requirements as are directed in Section eleven (11) of this act.

Payment of owner to contractor, when wrongful.

SEC. 33. No payments to the contractor or to his order shall be regarded as rightfully made, as against the sub-contractor, or party furnishing materials, if made by the owner without exercising or enforcing the rights and powers conferred upon him in Sections five (5) and twenty-three (23) of this act.

SEC. 34. No petition shall be filed or suit commenced to enforce the lien created by Sections twenty-two (22) and twenty-three (23) of this act, unless the same is commenced within four months after the time that the final payment is shown to be due the sub-contractor or party furnishing material by the statement of the contractor, made as provided for in Section five (5); or of the sub-contractor, made as provided for in Section twenty-three (23); or by the notice, served or given as provided for in Sections twenty-five (25) and twenty-six (26); provided, if any delay in filing such petition or commencing suit is caused in consequence of the final payment not being due the contractor, the time of such delay shall not be reckoned.

SEC. 35. Upon the written demand of the owner, lienor, or any person interested in the real estate, or their agent or attorney, served on the person claiming the lien, or his agent or attorney, requiring suit to be commenced to enforce the lien, or answer to be filed in a pending suit, suit shall be commenced or answer filed within thirty days thereafter, or the lien shall be forfeited and the same released, if a claim for lien has been filed with the clerk of the Circuit Court.

SEC. 36. Whenever a claim for lien has been filed with the clerk of the Circuit Court, either by the contractor or the sub-contractor, and is afterward paid,

with cost of filing same, or where there is a failure to institute suit to enforce the same after demand, as provided in the preceding section, within the time by this act limited, the person filing the same, or some one by him duly authorized in writing to do so, shall acknowledge satisfaction or release thereof in the proper book in such office, in writing, on written demand of the owner; and on neglect to do so for ten days after the claim has been paid or the time has expired to bring suit thereon, he shall forfeit to the owner the sum of twenty-five dollars ($25), which may be recovered in an action of debt before a justice of the peace.

SEC. 37. Any owner, contractor, sub-contractor or other person who shall purchase materials on credit and represent at the time of purchase that the same are to be used in a designated building or buildings, or other improvement, and shall thereafter sell, use or cause to be used the said materials in the construction of, or remove the same to, any building or improvement other than that designated, or dispose of the same for any purpose, without the written consent of the person of whom the materials were purchased, with intent to defraud such person, shall be deemed guilty of a misdemeanor, and, on conviction, shall be punished by a fine not exceeding five hundred dollars ($500), or confined in the county jail not exceeding one year, or both so fined and imprisoned.

SEC. 38. Any architect, contractor, sub-contractor, material man, or other person furnishing services, labor or material for the purpose of or in constructing, building, altering, repairing or ornamenting a boat, barge or other water craft shall have a lien on such boat, barge or other water craft for the value of such services, labor or material in the same manner as is in this act provided for services, labor or material furnished by such parties for the purpose of building, altering, repairing or ornamenting a house. And such lien may be established and enforced in the same manner as like liens are established and enforced under this act, and the parties shall be held to the same obligations, duties and liabilities as in the case of a contract for building, altering, repairing or ornamenting a house.

SEC. 39. The clerk of the Circuit Court shall endorse on the statement filed pursuant to the provisions of Sections one (1) and six (6), the date of filing, and note in a book kept for that purpose and properly indexed, the name of the contractor filing the statement, of the persons contracted with, the date of filing, a description of the property charged with the lien, the amount claimed and the date for final payment, for which the persons filing the statement shall pay one dollar ($1) to the clerk.

When claims for lien are filed pursuant to the provisions of Sections seven (7) and twenty-six (26), the clerk of the Circuit Court shall endorse thereon the date of filing, and make an abstract thereof in a book kept for that purpose and properly indexed, containing the name of the person filing the lien, the amount of the lien, the date of filing, the name of the persons against whom the lien is filed, and a description of the property charged with the lien, for which the person filing the lien shall pay one dollar to the clerk.

SEC. 40. Sections one to forty-seven, inclusive, of an act entitled, "An Act to revise the law in relation to liens," approved March 25, 1874; and an act entitled, "An Act to amend Section twenty-eight of an act entitled, 'An Act to revise the law in relation to liens,'" approved March 25, 1874, approved May 24, 1879; and an act entitled, "An Act to amend Sections four and twenty-eight and add Sections fifty-two, fifty-three and fifty-four to 'An Act to revise the law relating to liens,'" in force July 1, 1874, approved May 31, 1887; and an act entitled, "An Act to amend Sections twenty-nine, thirty and thirty-five, and repeal Sections thirty-six, forty-two, forty-three and forty-four of an act entitled, 'An Act to revise the law in relation to liens,'" approved March 25, 1874, in force July 1, 1874, approved June 16, 1887; and an act entitled, "An Act to amend Sections eleven, thirty-three, thirty-four and thirty-five of 'An Act to revise the law in relation to liens,'" approved March 25, 1874, in force July 1, 1874, as amended by an act approved June 16, 1887, and in force July 1, 1887, approved June 22, 1891; and all other acts and parts of acts inconsistent with this act are hereby

repealed, except as herein reënacted; *Provided*, that this section shall not be so construed as to affect any rights existing or actions pending at the time this act shall take effect.

SEC. 41. This act is and shall be construed as a remedial act, and shall take effect and be in force from and after its passage.

Approved June 26, 1895.

In force July 1, 1895.

GRAVEL ROOFING.

Probably the most important part of a building is the roof. Unfortunately this fact is too often overlooked, and the cheapness at which it can be put on has generally been considered rather than the durability. Guarantees have been given by roofers for work to last ten years which in reality are good for only two or three at most. A responsible roofer will hesitate to sign a contract for an ordinary four-ply roof with the ten-year clause attached, and in letting such contract the architect will act wisely by giving directly to a responsible roofer and not let it with some other branch of the building; or if it be so let, the original contractor should sign the guarantee with the roofer. Fifteen-pound felt (single thickness) to the 100 feet is standard weight, and serves its purpose better than the heavier brands, which are liable to crack when bent and will not make good joinings, and will wrinkle after being laid. If too light, the composition strikes through the felt and sticks it to the sheathing boards.

A good many roofs are put on with felt of 8, 10 or 12 pounds to the square, and with very little roofing cement. Five or six ply — one of them dry — and four or five, as the case may be, saturated and then mopped over and a cap sheet applied, should make the foundation for a roof to last ten years, or even fifty if occasionally overhauled. Care should be taken to use good cement with the screened gravel. There are many worthless cements on the market.

Appended are three specifications for good work:

Five (5) Ply Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred (100) pounds of roofing cement to the square of one hundred (100) feet. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Ply Cap Sheet Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along the

walls and around the openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through 5/8-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Ply Combined Flax and Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put one (1) layer of flax felt and three thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than eleven (11) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through 5/8-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

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MECHANICAL PLANTS OF LARGE BUILDINGS.

BY DANKMAR ADLER, MEM. W. S. E.

It is only within a very few years that the general public has begun to realize the extent and the importance of the machinery plants, without which our large business buildings of every type could not be occupied or used. Business men could not bring themselves to believe that the engineering equipment necessary for promoting the comfort and health of the permanent and transient occupants of a large business building could equal, much less exceed, in importance, magnitude or difficulty the mechanical plant of an ordinary factory. In those days the trusted engineering expert was for each business man interested in a steam plant his own "engineer," so called because he periodically opened and closed the throttle of an engine, which he oiled and cleaned and looked after generally, when not occupied with the shoveling of coal or the removal of clinker and ash. But as each of these so-called "engineers" rarely had more than his own observations and experiences to fall back upon, and as the collated records of the world's work and the comparisons, researches and conclusions based thereon were to him a sealed book, his mental horizon was painfully narrow. If such men were enterprising and progressive, they were apt to favor the use of expedients before tried by others and found impracticable, or if, as was more generally the case, they were obstinately and honestly conservative, they opposed innovations upon the practice known to themselves with a doggedness of purpose which generally carried conviction to the minds of their employer. As a consequence the heat and power plants of the business buildings erected in the sixties, seventies and early eighties were exceedingly crude and wasteful. Sixty pounds was the maximum steam pressure used. It was always safe to assume that either boiler or stack, or both, were too small. Exhaust steam was always blown into the air, barrels of water of condensation were run into sewers. Pipes were irregularly, ignorantly and arbitrarily proportioned, and there was scarcely a time during the period of operation of steam-heating apparatus when the ear was not assailed by sounds reminding an old soldier of the transition from lively skirmish to actual battle.

It was a blessed era for contractors. Their specifications and their planning became the final refuge of the coal-shoveling engineer. The contractor was bound to have his own way, for he claimed that otherwise he could not be held responsible for results. And then after the contractor had had full swing and, as was often the case, the results were not satisfactory to the employer, that person was an ungracious scamp, a blasphemous railer at the dispensations of Providence, a derider of the laws of nature; the contractor certainly couldn't be expected to make warm weather at a time when it pleased Providence to send cold, or to make water run up hill, or to make air and water occupy the same space at the same time.

But throughout all these years education through adverse experiences of clients, architects and contractors was going on. By the end of the eighties there were clients who had learned that valuable knowledge in the field of steam, mechanical and electrical engineering might be found in the possession of men not clad in overalls, and that a soot and oil stained hand and face were not essential concomitants of the possession of the kind of knowledge which is necessary for the proper proportioning of first cost, and of cost of maintenance and operation to the general requirements of the machinery plant of a given building.

Some architects had learned to note not only cubic contents but also the exposure to radiation of rooms to be warmed, and to proportion radiators accordingly. They had learned that it was possible to ascertain the work to

be done in each of the various pipes, and that their dimensions might be made to bear certain relations to such work ; and last but not least, the relations of output of steam to heating surface and grate surface, and the relation of the latter to stack dimensions had come to be understood.

The same educational influences were at work with the contractors, and before the beginning of the last decade of this century the work of the professional engineer was more or less in evidence as a component part of the design of buildings containing heating or ventilating apparatus or making use of mechanical or electrical energy in any form.

Electrical energy — electricity; that was a new complication which, while ultimately a stimulus to far-reaching progress, was at first a most serious retardent of progress in the application of engineering science and skill to the design and construction of buildings. Here was an occult and mysterious force expected to work miracles and obeying only the commands of wizards and magicians initiated into the mysteries of its manifestations. *Science, obedience to natural laws, and calculable by the rules which govern the operations of all mechanism! Faugh!!* Had not men of science at one time scoffed at the possibility of accomplishing the very things which are now revealing themselves to our wondering gaze? Had not the evidence of these same alleged natural laws, of these same so-called mechanical principles been invoked to prove the correctness of the scientific negations of these realizations of dreams of Arabian Nights? As the performance of the newly discovered power seemed to surpass the wildest possible flights of the imagination, it seemed that naught but hyperbolic statements might be believed with regard to all connected with its application to the service of any building. The sober statements of adepts in mechanical and steam engineering were scoffingly set aside as the envy-inspired utterances of men who felt that their vocation was vanishing, or decried as the wail of those despairing over the inevitable supplanting by electricity of steam and of steam-driven mechanisms. For a time the field of engineering design was in possession of the salesmen of producers of electric apparatus, and he was the best salesman, and, therefore, the best engineer, who could promise the performance of the most incredible marvels. With the new industry had come a vocabulary of technical terms, with reference to which the general public was in total ignorance, while its shibboleth had been but partly mastered by the engineers of the day. But the salesman, filled to the brim with the words and phrases of the glossary of electrical technics, sought to drown the reasoning faculties of his hearers in torrents of terms and phrases whose significance was not at all clear to the speaker, and still less so to the hearer. Contracts after contracts were made without any clear understanding as to their meaning, except that in every case there was on one side an expectation that by the introduction of electricity the heretofore unattainable would be attained, while on the part of the other party there was the determination to transfer a substantial share of the first party's money to the coffers of the owners of patents for systems of electrical all sorts of things, coupled, of course, with the hope that a kind Providence might bring about the fulfillment of the expectations aroused in the mind of the purchaser of electrical apparatus.

By and by this condition of things became unbearable, and the initiative in a reform movement was taken when contracts for electric installations made their appearance containing a clause by which contractors were absolved from responsibility for fulfillment of salesmen's representations and promises unless such were specifically incorporated in the contracts. Up to this time purchasers of electric installations had "held up" the contractors because of their inability to accomplish what their salesmen had promised. Now, contractors "held up" purchasers by means of a contract composed of ingeniously conceived and carefully limited technicalities, erected upon a preparatory foundation of vague, indefinite and all-promising salesmen's generalities and promises.

It may be asked, where during all this period, covering nearly ten years, was the engineer? At first he didn't exist, at least as far as the earlier electric

nstallations were concerned. The science of electrical engineering had first to be developed before electrical engineers could be educated. The irresponsibility and wildness of the claims made by the owners of patents for electric apparatus disgusted and estranged the educated mechanical engineers. The production and application of the electric current seemed enveloped by fantastic clouds of mystery which had been created by the irresponsibly and irrepressibly valuable salesmen, styled engineers by their employers. Electrical engineering was deemed but little removed from the black art, and assumed to be wholly empirical. It was understood and practiced by the Wizard of Menlo Park and by a few of his disciples. Its mysteries were beyond the ken or reach of a mere matter-of-fact creature of formulas and figures like the mechanical engineer, for whom there would be no room on earth in the good time coming, when electricity would supersede steam and water, when the unchaining of more or less lightning would perform all of the world's work.

The persons interested in the commercial exploitation of electrical patents and processes had, in the purchase of these patents, had their own imaginations worked upon, and proceeded in good faith to sell attempted realizations of the fanciful dreams which they had bought. But before long they learned to know the dangers which attend obligations to deliver many undefinable imaginary somethings, and then came the consciousness that perhaps it might be well to find persons who could define and limit the things to be accomplished by an electrical installation. And this was the genesis of the electrical engineer, whose function was for years the effort to reduce to terms profitable to his employers the fraction $\frac{\infty}{\infty}$ in which the numerator represented the expectations excited in purchasers of electric installations of patented electric apparatus by the weirdly plausible pseudo scientific jargon of the salesman, while the denominator represented the passionate longing of the owners of these patents for dividends upon the untold millions of capitalization represented by cost of original patents by experimentation and litigation, and last, but not least, by irrigation.

Eventually the managers of the great companies which had absorbed the patents for so many electrical appliances and processes learned that the symbol ∞, however befitting an incantation or a spiritualistic seance, is out of place in any part of any business transaction, and the services of the engineer were invoked to determine in finite terms of exact science the conditions of promise as well as the work of fulfillment of their various contracts with the public.

Following this recognition of the value of the services of the electrical engineer as an adept in an exact science rather than as a wizard and an invoker of dreams, the technical schools of two continents vied with each other in turning out graduates who were rapidly absorbed by the ever-widening fields opened in every branch of engineering activity in which our sky-piercing business buildings occupy a most conspicuous position.

Emerging from the stupor and the trance-like condition into which the advent of electricity and the Saturnalian clamor of its votaries had thrown them, owners and architects of buildings, and the engineers associated with them, at last felt free to treat the lifting of water, of chattels and of persons, the warming and ventilating as well as the artificial illumination of their buildings, as correlated interdependent problems, capable of so'ution by scientific and businesslike statements of equations of which the world's store of observed, recorded and collated facts are on one side, the peculiar conditions of use, service and environment of the building in hand on the other, and a maximum of commercially efficient economy is the solution sought for.

While this statement of the situation is, and probably will always remain true, the elements of the equation are ever shifting. On the one side the world's store of knowledge is continually increasing, and the relative importance of the observed and recorded facts changes with each new discovery. So also is the other side constantly being modified by changes in the occupations and the

demands of men and of business and by the desire to utilize fully the advances made in man's power of command over the elements and forces of nature, and, finally, we are forever raising the standard of that maximum of possible attainment by which the allowable limit of error in our solution is determined.

The task set by their physical and psychic environment for owners, architects and engineers of buildings is therefore not by any means an easy one, even if only the ordinary and indispensable requirements are considered.

The following requirements for satisfying which mechanical appliances and apparatus are essential will be found in all business buildings and in every structure of many stories.

It is necessary to maintain at a moderately warm and approximately uniform temperature the interior of every building in which human beings spend any considerable portion of their time.

Water supply is required upon every floor of almost every building. In many instances hot as well as cold water must be so supplied.

In every case appliances are necessary for raising to and lowering from the upper stories goods, furniture and persons.

In every building means must be provided for artificial illumination.

Frequently mechanisms of various kinds must be driven, and occasionally artificial ventilation must be provided.

Heat, light or power, or any two or all of these may sometimes be obtained from extraneous sources, but in the case of buildings of magnitude or importance, can almost invariably and must generally be generated by apparatus especially installed for each individual building. The number of places where an external supply of heat is available is small, but there are numerous and constantly multiplying opportunities for procuring light and power from sources outside of any particular building. The efforts made by the purveyors of heat, and more especially those made by the purveyors of light and power, are vigorous and all-pervading. The question as to whether or not to yield to their importunities is being forced at every possible opportunity upon owners, architects and engineers of buildings.

In places where steam for heating and electric current for driving mechanisms and for illumination can be obtained from external sources at moderate cost, it will generally be found that the saving of space, economy in labor bills, avoidance of heat in summer and freedom from internally produced dust and soot at all times, bespeak favorable consideration for the external vender of heat, power and light; the exceptions being only those very large structures whose requirements are so vast that their heat, light and power stations can vie in economy of operation with the public station and whose service is so important that the risks of interruption in transmission from distant stations cannot be tolerated.

Second. Where steam can be had from the outside, but not electric current for power and light, the decision may depend upon the extent to which the two last mentioned are to be used. With small and intermittent use of power-driven mechanisms it may be better to drive a small engine with steam from outside than to produce it within the building. If a boiler installed within a building is used only as a generator of steam for heating purposes, it will generally be found better, for reasons which will be hereafter given under a different head, to procure steam from a constant and never-failing source of supply than to generate it within the building.

Third. Where there is no external source of steam supply, but where electric current can be introduced from without, the problem becomes more perplexing. One condition is ever present in the colder portions of the temperate zone. It is the necessity for circulating steam for warming purposes almost constantly during four months and periodically during three months of every year. If power and light are generated within the building, the exhaust steam is available with but slight loss of heating efficiency, and, therefore, with small fuel expenditure for cir-

culation in the warming system. During the same period the item of furnace and boiler attendance would be increased but little, if at all, by using the boiler also as a source of power and light supply. Again, in every year there are two months, and in some years three months, when artificial heat is required for but a short time each day and when sudden falls of temperature occur. At such times the presence of a constant supply of steam is a source of comfort. Where heat and light are obtained from external sources, and the boiler in the building is used for warming only, such unexpected and spasmodic periods of low temperature may come before the boiler has been started up for the winter, or after it has been shut down in the spring, or even if in operation, such drop in temperature may come suddenly at any time of a warm day when the fires are banked, so that much discomfort may ensue before the fires can be started and steam generated and circulated. And yet, on the other hand, it may not be possible to install a local power and light plant without occupying most valuable space, and the heating effect due to its operation in summer may produce discomforts during the whole of the hot months sufficient to counterbalance those encountered by reason of absence of steam circulation during an occasional cold spell in the spring or autumn. Of course, the difference in interest and maintenance charges is another element to be considered. Then also there is the question before referred to, as to whether power is used constantly or spasmodically, in large or in small volume.

Suppose now that the importunities of the representatives of central stations have been disposed of and that the kind of installation best fitted for a building has been determined upon.

The first and most important item is the heating apparatus. Here it becomes necessary to tabulate cubic contents, exposure to points of the compass, areas of windows, walls and roofs, thickness of walls, and to note the kind of occupation required, and by the aid of the excellent work done by way of experimentation by German engineers, translated and condensed for American practice by my friend, Alfred R. Wolff, of New York, to determine the heating surface required in each room, and to locate the same in such manner as to be at once efficient and out of the way of furniture. Then comes the determination of pipe dimensions, and incidentally with this, whether there is to be a one or a two pipe system, and whether the horizontal distributing mains are to be at the top or at the bottom. All the better modern practice tends to the one-pipe system, and in a very high building to overhead distribution. It may be taken for granted that the working pressure will be five pounds or less, and that the piping must be such as to allow of circulation at a pressure of not more than eight ounces. Where steam is used for driving engines, the exhaust steam must be utilized; there must be a steam storage tank, which serves as a source of supply to the heating pipes, independently of the boiler.

It is a fact, the existence of which must be regretted, but which for all that is an essential consequence of unavoidable conditions, that boiler and engine rooms will be located only in the cellars of business buildings. In Chicago, up to within about eleven years ago, the impossibility of draining basements below sewer level made it impossible to use large boilers or deep fire boxes or ash pits. The introduction of the automatic sewage ejector has made it possible to secure drainage at any desired depth below the city sewers, and makes it possible to design boilers and their settings without much regard to the space to be occupied vertically. By thus lowering the boiler and engine room floors, the boiler and pipes can be kept at greater distance from basement ceiling, and thus the transmission of heat through the floor may be minimized.

As to smoke stacks, my favorite practice is to inclose a cast-iron or steel pipe in a shaft of brick or tile, using the latter as a ventilator for the boiler and engine room.

Next in order of importance is the elevator system.

The old-fashioned steam elevator, while perhaps the most reliable of all known hoisting machines, is also the most wasteful of steam.

Next comes the horizontal cylinder multi-sheave hydraulic machinery, driven by an ordinary steam pump — 80° steam per horse-power hour, fifty per cent efficiency of hydraulic machines; next the vertical cylinder multi-sheave hydraulic machine, a little higher in economic efficiency of motion, but also dependent on a wasteful pumping apparatus (the same may be said of the water balance elevator). Of some one of these types are all the elevators erected up to within a very few years ago. This, however, must be said for them; they are safe, easy of control and smooth of operation — but they are fearfully and wonderfully wasteful of fuel.

The first reform made was one that is possible only in buildings in which many elevators are used, so as to bring water consumption near to a uniform average, and thus make the use of a better pump a possibility. This was first accomplished at the Auditorium, where twenty-two elevators are run from pumps which in a continuous test run of two weeks' duration and continuous night and day work developed a duty of about twenty-eight pounds per horse-power hour.

The multi-sheave electric screw elevator shares some of the good qualities of the horizontal cylinder hydraulic elevator and also the waste of energy due to the friction caused by its many sheaves, which becomes appalling in a very high structure.

All electric elevators have this advantage over hydraulic elevators: while the latter use as much power in lifting a light as in handling a heavy load, the electric elevator makes an approximation to using power in proportion to load. The large volume of starting current required partly offsets this advantage. In elevators of all kinds, counter-weighting for average loads may be made a means of increasing economic efficiency.

In small buildings with less than three elevators, or wherever the elevator duty is intermittent, the electric elevator will give better economic results, also where power is taken from an outside source.

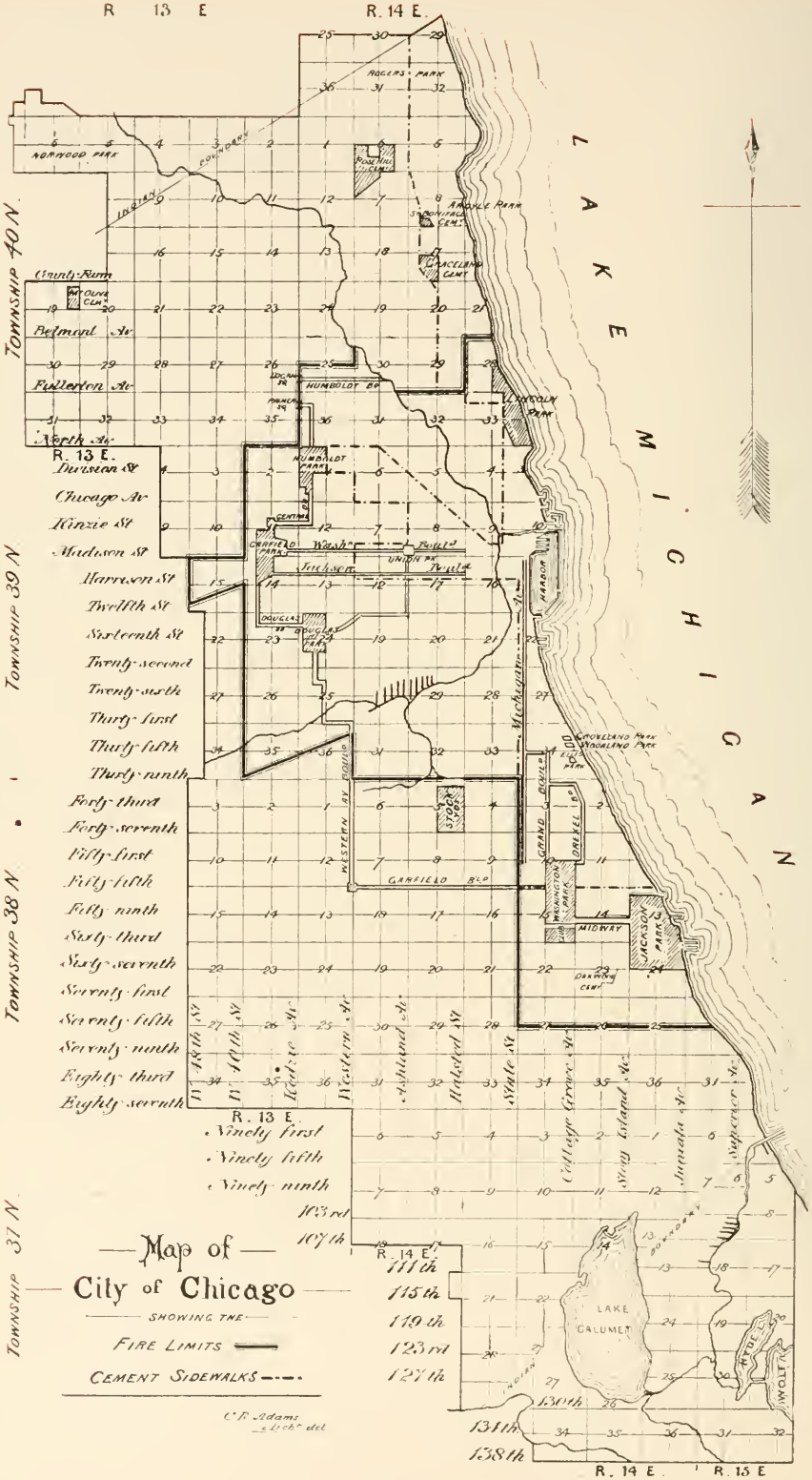
It is, however, possible that the electrically driven centrifugal pump may restore the hydraulic elevator to universal favor and that it may make it possible to rival the directly connected, electric elevator engine in its claims to economy.

Turning now to the electric apparatus of our buildings it may be said that in determining number and capacity of generators for electric current, and of the engine by which they are driven, heed must be paid to maximum average and minimum loads and to securing a moderate reserve capacity. If electric elevators are used they must be driven by separate generators, or a storage battery must be introduced. On the whole it will probably be preferable to couple generators direct to engines, giving the outboard bearings. Foundations of engines and generators should be separated from those of the building, and every possible precaution should be taken, first, to prevent vibration and noise, and next to insulate all possible sources of vibration and noise from the structural members of the building.

As to water supply it will be found better to pump from an open surge tank than to follow the general practice of using a closed one.

It will always be found advantageous to have one or more shafts from the engine room to the top of the building for conveying pipes, cables, etc.

But my subject is one about which one might go on forever without exhausting its many phases. The presentation of these may safely be left to others of our members better fitted than I by education and practice in each of the many details of engineering practice which would have to be exhaustively considered.


R 13 E
R. 14 E.
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TOWNSHIP 39 N.
TOWNSHIP 38 N.
TOWNSHIP 37 N.
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R. 14 E.
R. 15 E
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Fullerton Av
North Av
Division St
Chicago Av
Kinzie St
Madison St
Harrison St
Twelfth St
Sixteenth St
Twenty-second
Twenty-sixth
Thirty-first
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138th
ROGERS PARK
NORWOOD PARK
ROSE HILL CEM.
ARCADIA PARK
CONIFER CEM.
GRACELAND CEM.
County Farm
OLIVE CEM.
LINCOLN PARK
HUMBOLDT PARK
GARFIELD PARK
DOUGLAS PARK
UNION PK
HARBOR
STOCK YARDS
WASHINGTON PARK
MIDWAY
JACKSON PARK
OAKWOOD CEM.
ROSELAND PARK
WOODLAND PARK
LAKE CALUMET
HYDE PARK
WOLTA
Western Av
Ashland Av
Halsted St
State St
Cottage Grove Av
Stony Island Av
Jeffery Av
Superior Av
Map of
City of Chicago
SHOWING THE
FIRE LIMITS
CEMENT SIDEWALKS
C. P. Adams
Litch. del

ORDINANCE FOR EXTENSION OF FIRE LIMITS.

Passed December 11, 1893.

That the fire limits of the City of Chicago be, and the same are hereby extended, so as to include the territory bounded on the east by the center line of West Fortieth street, on the west by the center line of West Forty-sixth street, on the south by the center line of Colorado avenue and on the north by the center line of Madison street.

This ordinance shall be in force from and after its passage.

The fire limits of the City of Chicago are hereby extended so as to include all that part of the city lying west of the Chicago river, east of Kedzie avenue, north of North avenue and south of Diversey avenue.

This ordinance shall be in force from and after the first day of May, 1895.

That the fire limits of the City of Chicago are hereby extended so as to include the territory bounded on the east by the shore of Lake Michigan, on the west by the center line of State street, on the south by the center line of Seventy-fifth street, and on the north by the center line of Sixty-seventh street; provided, however, that any person or corporation desiring to erect or remove a frame or wooden building within the above defined limits, shall have the right to do so upon presenting a petition to the Commissioner of Buildings, signed by the owners of a majority of the front feet for a distance of 500 feet each way from said lot upon each side of the street upon which the building is to be located.

NOTE.

FIRE LIMITS.—On the south by Seventy-fifth street from the lake to State street, west by State street to Thirty-ninth street, south by Thirty-ninth street to South Western avenue, west by South Western avenue to the Illinois and Michigan canal, south by the Illinois and Michigan canal to Crawford avenue, west by Crawford avenue to Colorado avenue, south by Colorado avenue to West Forty-sixth street, west by West Forty-sixth street to Madison street, north by Madison street to Crawford avenue, west by Crawford avenue to West North avenue, north by West North avenue to Kedzie avenue, west by Kedzie avenue to Diversey avenue, north by Diversey avenue to the Chicago river, east by the river to Fullerton avenue, north by Fullerton avenue to Halsted street, west by Halsted street to Belmont avenue, north by 150 feet north of the north line of Belmont avenue to the lake.

THE NEWGARD WATERPROOF ELECTRIC RECEPTACLE

Is a combination of waterproof socket and waterproof globe complete in one appliance. A single piece of porcelain forms a socket or receptacle for the lamp, and the cover for the globe. The conducting wires are permanently sealed in this porcelain cap which is threaded into the receptacle, and the glass globe and rubber gasket in the cover create a water-tight fitting between the cover and the globe, making an outfit which can be used under water.

Its largest field of usefulness is in breweries, packing houses and for similar work where it is customary to wash the floors, walls and ceilings with showers of water. It will be found to be a solution of the difficulty in all places where severe conditions have heretofore made a perfect insulation of lamp and socket an impossibility, such as in cold storage warehouses, paper mills, etc.

The receptacle is made regularly with T.-H. base, but can be used with Edison lamp by use of a T.-H. Adapter. The globe will take either a 16 or 32 C. P. lamp, the opening in the globe being 2¾ inches. The length of the globe is 6 inches, while 7 inches is the length of the outfit over all.

Although just introduced, several hundred have already been placed in Chicago breweries, and the results secured have been most satisfactory.

Electric power and electric lighting are good in dry places, but they become troublesome in damp or wet. For breweries and packing houses, etc., it is something that was needed.

MISCELLANEOUS AND USEFUL INFORMATION.

Useful Notes.

Roof boards weigh about three pounds per superficial foot.

Terra cotta tiling weighs from 25 to 35 pounds per square foot.

Hollow tile for five-inch partition weighs from 22 to 25 pounds per superficial foot.

Lath and plastering, two-coat work, weighs from 9 to 12 pounds per superficial foot.

The weight of a superficial foot of brickwork eight inches thick, including mortar, is from 83 to 87 pounds.

An iron roof 100 feet wide with a rise of one-third pitch will weigh from 10 to 15 pounds per superficial foot.

One hundred pounds per square foot distributed uniformly over a surface of a bridge is a safe working standard.

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

A fireproof floor constructed of iron beams and four-inch brick arches will weigh from 65 to 75 pounds per superficial foot.

The safe and proper bearing of joist, timber and girders supporting a floor should not exceed ten tons on brick walls and fourteen tons on good stone walls.

A fireproof floor constructed of iron beams and of iron arches made of No. 18 iron, and filled in on top with concrete or slag and cement, will weigh about the same as brickwork four inches thick.

Smallest Convenient Size of Slab for a 14-inch washbowl, 21 by 24 inches. Height of slab from floor, 2 feet 6 inches. Very small (12-inch) corner washbowl: slab 1 foot 11 inches each side.

Space Occupied by Water Closets, 2 feet 6 inches wide, 2 feet deep.

Urinals should be not less than 2 feet 2 inches between partitions; partitions 6 feet high.

Horse Stalls.—Width, 3 feet 10 inches to 4 feet, or over 5 feet in width and 9 feet long. Width should not be between 4 and 5 feet, as in such cases the horse is liable to cast himself.

Pitch of Tin, Copper or Tar and Gravel Roof.—Five-eighths of an inch to the foot and upward.

A Load of Mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A Bricklayer's Hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A Single Load of Sand or other materials equals a cubic yard.

One Thousand Bricks closely stacked occupy about fifty-six cubic feet.

One Thousand Old Bricks cleaned and loosely stacked occupy about seventy-two cubic feet.

One Hundred Yards of Plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A Bushel of Hair weighs, when dry, about fifteen pounds.

Flashings.—By "flashings" are meant pieces of tin, zinc or copper laid over slate, and up against wall, chimneys, copings, etc.

Counter Flashings are of lead or zinc, and are solid between the courses in brick, and turned down over the flashings.

In flashing against stonework, grooves should be cut to receive the counter flashing.

Water.

1 cubic foot of water = 62.5 pounds, or 7.48 U. S. gallons.
1 cubic inch of water = .036 pounds.
1 cubic foot of water = 6.2355 Imp. gallons or 7.48 U. S. gallons.
1 cylindrical foot of water = 49.1 pounds or 5.89 U. S. gallons.
1 U. S. gallon of water = 8.34 pounds.
1 U. S. gallon of water = 231. cubic inches.

1 pound pressure per square inch is equivalent to a head of water of 2.3093 feet; 1 pound — 27.71 inches; 14.7 pounds or 1 atmosphere — 33.947 feet, or 10.347 metres; 0.433 pounds or 1 atmosphere — 1 foot. 43.3 pounds — 100 feet.

Capacities of Cisterns.

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.					SQUARE CISTERN.				
5	feet in	diameter	holds	4.66 bbls.	5	feet by	5 feet	holds	5.92 bbls.
6	"	"		6.71 "	6	"	6 "		8.54 "
7	"	"		9.13 "	7	"	7 "		11.63 "
8	"	"		11.93 "	8	"	8 "		15.19 "
9	"	"		15.10 "	9	"	9 "		19 39 "
10	"	"		18.65 "	10	"	10 "		23 74 "

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. Odor: Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. Taste: If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

* Greatest density at 39.1° Fahr.

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
Inches.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.
3.....	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4.....	1 in 92	96	1 in 40.8	144	1 in 23	192	1 in 10.2	288
6.....	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9.....	1 in 207	495	1 in 92	742.5	1 in 51.7	990	1 in 23	1,485

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch.	Feet Head	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch
1	.43	65	28.15	130	56.31	195	84.47	260	112.62	350	151.61
5	2.16	70	30.32	135	58.48	200	86.63	265	114.79	360	155.94
10	4.33	75	32.48	140	60.64	205	88.80	270	116.96	370	160 27
15	6.49	80	34.65	145	62.81	210	90.96	275	119.12	380	164.61
20	8.66	85	36.82	150	64.97	215	93.14	280	121.29	390	168 94
25	10.82	90	38.98	155	67.14	220	95.30	285	123.45	400	173.27
30	12.99	95	41.15	160	69.31	225	97.49	290	125.62	500	216 58
35	15.16	100	43.31	165	71.47	230	99.63	295	127.78	600	259.90
40	17.32	105	45.48	170	73.64	235	101.79	300	129.95	700	303.22
45	19 49	110	47.64	175	75.80	240	103.96	310	134.28	800	346.54
50	21.65	115	49.81	180	77.97	245	106 13	320	138.62	900	389.86
55	23.82	120	51.98	185	80.14	250	108.29	330	142.95	1,000	433.18
60	25.99	125	54.15	190	82.30	255	110.46	340	147.28		

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter.	Outside Diameter.	External Circumference. A	Length of Pipe per Sq. Foot of Outside Surface.	Internal Area.	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In.	In.	Ft.	In.	In.	Ft.	Lbs.			Lbs.
⅛	.40	1.272	9.44	.012	.129	2,500.	.24	27	.0006	.005
¼	.54	1.636	7.075	.049	.229	1,385.	.42	18	.0026	.021
⅜	.67	2.121	5.657	.110	.358	751.5	.56	14	.0057	.047
½	.84	2.652	4.502	.196	.554	472.4	.84	14	.0102	.085
¾	1.05	3.299	3.637	.441	.866	270.	1.12	11½	.0230	.190
1	1.31	4.134	2.903	.785	1.357	166.9	1.67	11½	.0408	.349
1¼	1.66	5.215	2.301	1.227	2 164	96.25	2.25	11½	.0638	.527
1½	1.9	5.959	2.01	1.767	2.835	70.65	2.69	11½	.0918	.760
2	2.37	7.461	1.611	3.141	4.330	42.36	3.66	8	.1632	1.356
2½	2.87	9.032	1.328	4.908	6.491	30.11	5.77	8	.2550	2.116
3	3.5	10.996	1.091	7.068	9.621	19.49	7.54	8	.3673	3 049
3½	4.	12.566	.955	9.621	12.566	14.56	9.05	8	.4998	4.155
4	4.5	14.137	.849	12.566	15.904	11.31	10.72	8	.6528	5.405
4½	5.	15.708	.765	15.904	19.635	9.03	12.49	8	.8263	6.851
5	5.56	17.475	.629	19.635	24.299	7.20	14.56	8	1.020	8.500
6	6.62	20.813	.577	28.274	34.471	4 98	18.76	8	1.469	12.312
7	7.62	23.954	.505	38 484	45.663	3.72	23.41	8	1.999	16.662
8	8.62	27.096	.444	50.265	58.426	2.88	28.34	8	2 611	21.750
9	9 68	30.433	.394	63.617	73.715	2.26	34 67	8	3.300	27.500
10	10.75	33.772	.355	78.540	90.792	1.80	40 64	8	4.081	34.000

* The Standard U. S. gallon of 231 inches.

Multiply the external circumference column, A, by 12, and the result will be the square feet of surface per lineal foot.

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear.	Thickness of Brickwork.	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard.
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Solders.

	Copper.	Tin.	Lead.	Zinc.	Silver.	Bismuth.	Gold.	Cadmium.	Antimony.
Tin		25	75						
Tin		58	16			16			10
Tin, coarse, melts at 500°		33	67						
Tin, ordinary, melts at 360°		67	33						
Spelter, soft	50			50					
Spelter, hard	65			35					
Lead		33	67						
Steel	13			5	82				
Brass or Copper	50			50					
Fine Brass	47			47	6				
Pewterer's, or soft		33	45			22			
Pewterer's, or soft		50	25			25			
Plumber's pot metal		33	67						
" " coarse		25	75						
" " fine		67	33						
" " fusible		50	50						
" " very fusible		25	25			50			
Gold	4				7		89		
Gold, hard	66			34					
Gold, soft		66	34						
Silver, hard	20				80				
Silver, soft	12				67			21	
Pewter		40	20			40			
Iron	66			33					1
Copper	53	47							

Length in Feet of Joists, Scantling and Timber.

Size in Inches.	12	14	16	18	20	22	24	26	28	30	42	44	45
2 x 4	8	9	11	12	13	15	16	17	19	20	28	29	30
2 x 6	12	14	16	18	20	22	24	26	28	30	42	44	45
2 x 8	16	19	21	24	27	29	32	35	37	40	53	58	60
2 x 10	20	23	27	30	33	37	40	43	47	50	70	74	75
2 x 12	24	28	32	36	40	44	48	52	56	60	84	88	90
3 x 4	12	14	16	18	20	22	24	26	28	30	42	44	45
3 x 6	18	21	24	27	30	33	36	39	42	45	63	66	68
3 x 8	24	28	32	36	40	44	48	52	56	60	84	88	90
3 x 10	30	35	40	45	50	55	60	65	70	75	105	110	113
3 x 12	36	42	48	54	60	66	72	78	84	90	126	132	135
4 x 4	16	19	21	24	27	29	32	35	37	40	56	58	60
4 x 6	24	28	32	36	40	44	48	52	56	60	84	88	90
4 x 8	32	37	43	48	53	59	64	69	75	80	112	118	120
4 x 10	40	47	53	60	67	73	80	87	93	100	140	146	150
4 x 12	48	56	64	72	80	88	96	104	112	120	168	176	180
6 x 6	36	42	48	54	60	66	72	78	84	90	126	132	135
6 x 8	48	56	64	72	80	88	96	104	112	120	168	176	180
6 x 10	60	70	80	90	100	110	120	130	140	150	210	220	225
6 x 12	72	84	96	108	120	132	144	156	168	180	250	265	270
8 x 8	64	75	85	96	107	117	128	139	149	160	224	234	240
8 x 10	80	93	107	120	133	147	160	173	187	200	280	294	300
8 x 12	96	112	128	144	160	176	192	208	224	240	336	352	360
10 x 10	100	117	133	150	167	183	200	217	233	250	350	366	375
10 x 12	120	140	160	180	200	220	240	260	280	300	420	440	450
12 x 12	144	168	192	216	240	264	288	312	336	360	504	528	540
12 x 14	168	196	224	252	280	308	336	364	392	420	588	616	630
14 x 14	196	220	261	294	327	359	392	425	457	480	686	718	735

Rules for Calculating Speed of Pulleys.

I.— The diameter of the driver and driven being given, to find the number of revolutions of the driven :

Rule.— Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven ; the quotient will be the number of revolutions.

II.— The diameter and the revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time :

Rule.— Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions of the driven ; the quotient will be its diameter.

III.— To ascertain the size of the driver :

Rule.— Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the revolutions of the driver ; the quotient will be the size of the driver.

Belts.

Leather belts must be well protected against water, and even moisture.

India-rubber is the proper substance for belts exposed to the weather.

It is desirable to run the grain (hair) side of leather belts on the pulley, in order that the strongest part of the belt may be subject to the least wear.

Leather belts run with grain side to the pulley will drive thirty per cent more than if run with flesh side. The belt, as well as the pulley, adheres best when smooth, and the grain side adheres best because it is smoothest.

The transmitting power of a double belt is to that of single belt as 10 is to 7. In ordering pulleys, the kind of belt to be used should always be specified.

Belts should be kept soft and pliable. For this purpose blood-warm tallow, dried in by heat of fire or the sun, is advised. Castor-oil dressing is also good.

The motion of driving should run *with* and not *against* the laps of the belts.

If too great a distance is attempted, the weight of the belt will produce a very heavy sag, drawing so hard on the shaft as to produce great friction in the bearings, while at the same time the belt will have an unsteady, flapping motion, which will destroy both the belt and machinery.

If possible to avoid it, connected shafts should never be placed one directly over the other, as in such case the belt must be kept very tight to do the work. For this purpose belts should be carefully selected of *well-stretched* leather.

It is desirable that the angle of the belt with the floor should not exceed 45 degrees. It is also desirable to locate the shafting and machinery so that belts should run off from each shaft in opposite directions, as this arrangement will relieve the bearings from the friction that would result when the belts all pull one way on the shaft.

The diameter of the pulleys should be as large as can be admitted.

The pulley should be a little wider than the belt required for the work.

When it is not convenient to measure with the tape line the length required, apply the following rule : Add the diameter of the two pulleys together, divide the result by 2, and multiply the quotient by $3\frac{1}{4}$, then add this product to twice the distance between the centers of the shafts, and you have the length required.

The width of belt needed depends on three conditions : 1. The tension of the belt. 2. The size of the smaller pulley, and the proportion of the surface touched by the belt. 3. The speed of the belt.

The working adhesion of a belt to the pulley will be in proportion both to the number of square inches of belt contact with the surface of the pulley and also to the arc of the circumference of the pulley touched by the belt. This adhesion forms the basis of all right calculation in ascertaining the width of belt necessary to transmit a given horse-power.

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Weight per Square Foot of Sheet Lead.

$\frac{1}{8}$ inch thick	2 lbs.	$\frac{1}{10}$ inch thick	7 lbs.
$\frac{3}{64}$ " "	2½ "	$\frac{1}{8}$ " "	8 "
$\frac{1}{25}$ " "	3 "	$\frac{5}{32}$ " "	10 "
$\frac{1}{16}$ " "	4 "	$\frac{3}{16}$ " "	12 "
$\frac{1}{14}$ " "	5 "	$\frac{7}{32}$ " "	14 "
$\frac{1}{12}$ " "	6 "	$\frac{1}{4}$ " "	16 "

Gauges and Their Equivalents.

No. 27, equal to	$\frac{1}{64}$ inch.	No. 12, equal to	$\frac{7}{64}$ inch.
" 21, " "	$\frac{1}{32}$ "	" 10, " "	$\frac{1}{8}$ "
" 18, " "	$\frac{3}{64}$ "	" 8, " "	$\frac{11}{64}$ "
" 16, " "	$\frac{1}{16}$ "	" 6, " "	$\frac{3}{16}$ "
" 14, " "	$\frac{5}{64}$ "	" 5, " "	$\frac{7}{32}$ "
" 13, " "	$\frac{3}{32}$ "	" 4, " "	$\frac{1}{4}$ "

Capacity of Drain Pipe.

Size of Pipe.	Gallons per minute. ½-inch Fall per 100 feet.	3-inch Fall per 100 feet.	6 inch Fall per 100 feet.	9-inch Fall per 100 feet.	12-inch Fall per 100 feet.	18-inch Fall per 100 feet.	24-inch Fall per 100 feet	36-inch Fall per 100 feet.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Grade per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.	1 foot in 40 is 132 feet per mile.
1 " 20 is 264 " "	1 " 50 is 106 " "
1 " 25 is 211 " "	1 " 100 is 53 " "
1 " 30 is 176 " "	1 " 125 is 42 " "
1 " 35 is 151 " "	

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) is 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

To find the depth of a joist, the length of bearing and the thickness being given:

Rule.— Divide the square of the length in feet by the thickness in inches, and the cube root of the quotient, multiplied by 2.2 for pine, or 2.3 for oak, will be the depth in inches.

Slating.

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates Per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 by 12	533	8 by 16	277	12 by 20	141
7 " 12	457	9 " 16	246	14 " 20	121
8 " 12	400	10 " 16	221	11 " 20	137
9 " 12	355	9 " 18	213	12 " 22	126
7 " 14	374	10 " 18	192	14 " 22	108
8 " 14	327	12 " 18	160	12 " 24	114
9 " 14	291	10 " 20	169	14 " 24	98
10 " 14	261	11 " 20	154	16 " 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows :

Thickness in inches....	1/8	3/16	1/4	3/8	1/2
Weight in pounds.....	1.81	2.71	3.62	5.43	7.25

Handy Table.

Diameter of a circle × 3.1416 = circumference.
Radius of a circle × 6.283185 = circumference.
Square of the diameter of a circle × 0.7854 = area.
Square of the circumference of a circle × 0.07958 = area.
Half the circumference of a circle × half its diameter = area.
Circumference of a circle × 0.159155 = radius.
Square root of the area of a circle × 0.56419 = radius.
Circumference of a circle × 0.31831 = diameter.
Square root of the area of a circle × 1.12838 = diameter.
Diameter of a circle × 0.86 = side of inscribed equilateral triangle.
Diameter of a circle × 0.7071 = side of an inscribed square.
Circumference of a circle × 0.225 = side of an inscribed square.
Circumference of a circle × 0.282 = side of an equal square.
Diameter of a circle × 0.8862 = side of an equal square.
Base of a triangle × ½ the altitude = area.
Multiplying both diameters and .7854 together = area of an ellipse.
Surface of a sphere × 1/6 of its diameter = solidity.
Circumference of a sphere × its diameter = surface.
Square of the diameter of a sphere × 3.1416 = surface.
Square of the circumference of a sphere × 0.3183 = surface.
Cube of the diameter of a sphere × 0.5236 = solidity.
Cube of the radius of a sphere × 4.1888 = solidity.
Cube of the circumference of a sphere × 0.016887 = solidity.
Square root of the surface of a sphere × 0.56419 = diameter.
Square root of the surface of a sphere × 1.772454 = circumference.
Cube root of the solidity of a sphere × 1.2407 = diameter.
Cube root of the solidity of a sphere × 3.8978 = circumference.
Radius of a sphere × 1.1547 = side of inscribed cube.
Square root of (⅓ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × ⅓ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × ½ the sum of its parallel sides = area.

Table for Mixing Paints.

In forming the following named colors, mix as they come in order, the predominant being first; second, next; third, next, and so on:

Gray — use white lead and lampblack.
Buff — use white lead, yellow ocher and red.
Pearl — use white, black and blue.
Orange — use yellow and red.
Purple — use violet, red and white.
Gold — use white, stone ocher and red.
Olive — use yellow, blue, black and white.
Chestnut — use red, black and yellow.
Flesh — use white, yellow ocher and vermilion.
Limestone — use white, yellow ocher, black and red.
Fawn — use white, yellow and red.
Chocolate — use raw umber, red and black.
Drab — use white, raw and burnt umber; or, white, yellow ocher, red and black.
Bronze-green — use chrome green, black and yellow; or, black and yellow; or, yellow, black and green.
Pea-green — use white and chrome green.
Rose — use white, madder and lake.
Copper — use red, yellow and black.
Lemon — use white and yellow.
Snuff — use yellow and vandyke brown.

Shingle Stains

Should contain a large amount of creosote for their base, and the highest grades of English ground colors, and the proper amount of fixative oil to make the colors durable and lasting. Stains are artistic colorings, and give an effect that can be got in no other way. Stains can be applied with a brush, as paint is, after the shingles are laid, or the shingles can be dipped in the stain. The coloring effect is about the same in either case, but the dipping preserves the shingles best.

Covering capacity, based on the regulation sawed cedar shingle, 4 by 16, is as follows: One brush coat, 1 gallon to 150 square feet of surface; two brush coats, 1 gallon to 100 square feet of surface; dipping, 2½ gallons to 2¾ gallons to 1,000 shingles; dipping, and applying one brush coat after the shingles are laid, 3 gallons to 1,000 shingles. But two-thirds the length of the shingle need be dipped. When the roof-water is to be used for drinking, it should be turned off from the cistern until two or three hard rains have washed off the superfluous stain.

Dimensions of a Barrel. — Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

One Coat or Priming will take, for 100 yards of painting, twenty pounds of lead and four gallons of oil. Two-coat work, forty pounds of lead and four gallons of oil; three-coat, the same quantity as two coats; so that a fair estimate for 100 yards of three-coat would be 100 pounds of lead and sixteen gallons of oil.

A Box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and $8\frac{3}{5}$ inches deep will contain one bushel; 16 by $8\frac{3}{5}$ inches and 8 inches deep will contain half a bushel; 8 by $8\frac{3}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and $4\frac{1}{5}$ inches deep will contain one gallon; 7 by 4 inches and $4\frac{4}{5}$ inches deep will contain half a gallon; 4 inches square and $4\frac{1}{5}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal.

Hot-Water and Steam Heating — Overhead System.

In using steam for the heating of high buildings, it is necessary to use the overhead plan, unless some automatic system of expelling the air is adopted. It requires less power to force the air through the standpipe than it would through a large number of risers. The air is forced out on the descent of the steam, and less fuel and power are necessary.

The overhead hot-water system is coming into general use, as it can be put in so that the farthest radiators in a building will heat at the same time as those nearer the boiler, and the result will also be felt in rooms in the basement — the principle of the siphon causing the effect.

The pipes from the main in the attic, from which the several branches are taken, can be pitched so that heat in the several parts of a building will result as quickly as desired; either an open or closed tank can be used. The pipes exposed in attic should be covered. Opinions vary as to the sizes of pipe to be used.

RADIATION REQUIRED UNDER ORDINARY EXPOSURE.

	Width.	Length.	Height.	Ratio.	Square feet of radiation.
Parlor	15.6	16.6	10.0	50	51
Dining room	12	16.6	10.0	60	34
Hall	12	12	10.0	25	57
Chamber, front	13.6	15.6	9.6	55	36
Chamber, rear	12.6	16.6	9.6	60	32
Chamber	12.6	17	9.6	60	33
Bathroom	7	8	9.6	55	9
Chamber, attic	12.3	17	9	76	24
Chamber, rear	12 6	13.3	9	80	18

List of Sizes of Steam Mains.

To determine the size of pipes no fixed rule can be given which will apply in all cases. A rule that has generally been accepted by steam fitters as good practice, is to allow the area of a one-inch pipe (.7854 square inches) for every 100 square feet of radiating surface including mains.

Radiation.	One-pipe work.	Two-pipe work.
40 to 50 square feet	1 inch	¾ x ¾ inch
100 to 125 " "	1¼ "	1 x ¾ "
125 to 250 " "	1½ "	1¼ x 1 "
250 to 400 " "	2 "	1½ x 1¼ "
400 to 650 " "	2½ "	2 x 1½ "
650 to 900 " "	3 "	2½ x 2 "
900 to 1,250 " "	3½ "	3 x 2½ "
1,250 to 1,600 " "	4 "	3½ x 3 "
1,600 to 2,050 " "	4½ "	4 x 3½ "
2,050 to 2,500 " "	5 "	4½ x 4 "
2,500 to 3,600 " "	6 "	5 x 4½ "
3,600 to 5,000 " "	7 "	6 x 5 "
5,000 to 6,500 " "	8 "	7 x 6 "
6,500 to 8,100 " "	9 "	8 x 6 "
8,100 to 10,000 " "	10 "	9 x 6 "

THE ordinary speed to run a pump is 100 feet of piston per minute. To find the quantity of water elevated in one minute, running at 100 feet of piston per minute, square the diameter of the water cylinder in inches, and multiply by 4. Example: The capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) is 25, which multiplied by 4 gives 100, which is gallons per minute (approximately).

Tin Roofs.

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 by 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using ½-inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inches edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using ½-inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inches edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

Strains.

Tension, as in the case of a weight suspended from one end of a rod, rope, tie-bar, etc., the other end being fixed, tending to stretch or lengthen the fibers.

Shearing Strain, as in the case of tree nails, pins in bridges, etc., where equal forces are applied on opposite sides in such a manner as to tend to force one part over the adjacent one.

Compression, as in the case of a weight resting on top of a column or post, tending to compress the fibers

Transverse or Cross Strain, as in the case of a load on a beam tending to bend it.

Torsion, a twisting strain, which seldom occurs in building construction, though quite frequently in machinery.

Important Points in Figuring Dimensions of a Stable.

The proper height and width of a stable door is not less than nine feet square. Width and height of vehicles is as follows:

		Ft.	In.		Ft.		Ft.	In.
Brougham	height	7	0,	length	11,	width	6	0
Rockaway	"	7	0	"	11	"	6	0
Victoria	"	7	6	"	12	"	6	0
Demi-coach	"	7	0	"	12	"	6	0
Phaeton	"	8	6	"	10	"	6	0
Berlin coach	"	7	6	"	13	"	6	6
Landau	"	7	6	"	13	"	6	6
Double suspension victoria	"	8	0	"	13	"	7	0
Vis-a-vis	"	7	0	"	12	"	6	0
Body brake	"	9	0	"	11	"	7	0
Goddard phaeton	"	8	0	"	9	"	6	0
Stanhope	"	8	0	"	9	"	6	0
Buggy	"	9	0	"	9	"	6	0
Single trap	"	6	0	"	9	"	6	0
Mail coach	"	9	0	"	15	"	7	6
Omnibus	"	8	0	"	11	"	7	0

Metric Tables.

		Approximate Equivalent.	Accurate Equivalent.
1 inch	[length]	2½ cubic centimeters	2.539
1 centimeter		0.4 inch	0.393
1 yard		1 meter	0.914
1 meter (39.37 inches)		1 yard	1 093
1 foot		30 centimeters	30.479
1 kilometer (1,000 meters)		⅝ mile	0.621
1 mile		1½ kilometers	1.600
1 gramme	[weight]	15½ grains	15.432
1 grain		0.064 gramme	0.064
1 kilogramme (1,000 grammes)		2.2 pounds avoirdupois	2.204
1 pound avoirdupois		½ kilogramme	0.453
1 ounce avoirdupois (437½ grains)		28⅓ grammes	28.349
1 ounce troy, or apothecary (480 grains)		31 grammes	31.103
1 cubic centimeter	[bulk]	1.06 cubic inch	0.060
1 cubic inch		16⅓ cubic centimeters	16.386
1 liter (1,000 cubic centimeters)		1 United States standard quart	0.946
1 United States quart		1 liter	1.057
1 fluid ounce		29½ cubic centimeters	29.570
1 hectare (10,000 square meters)	[surface]	2½ acres	2.471
1 acre		0.4 hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

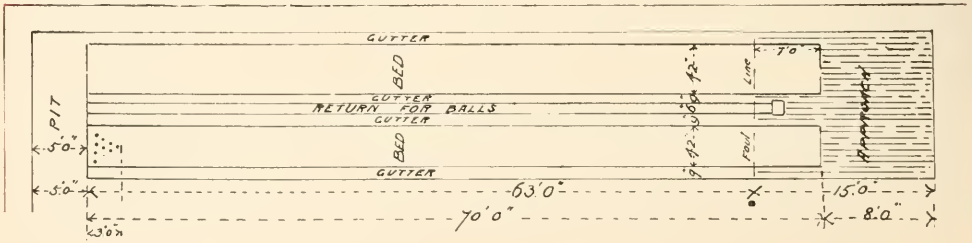
Size of the Billiard Room, Gas Lights, Etc.

The space required for the different sized tables is as follows:

For table 6	x 12	Room should be	16	x 22	
" 5½	x 11	"	" 15½	x 21	
" 5	x 10	"	" 15	x 20	
" 4½	x 9	"	" 14	x 18½	
" 4	x 8	"	" 13	x 17	
" 3½	x 7	"	" 12½	x 16	

The following directions for arranging the lights over billiard tables will be found useful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5½ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4½ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.

BOWLING ALLEY. STANDARD SIZE



POSTAL INFORMATION.

Domestic mail is divided into four classes, as follows:

Classes.	Postage.	Limit Weight.
First Class—Letters and sealed packages.....	2 cents each ounce or fraction thereof.....	No limit.
Postal cards	1 cent each	
Second Class—Newspapers, periodicals, entered as second class matter and sent by the publisher or news agents.	1 cent per pound.....	No limit.
Same when mailed by other than publishers or news agents.....	1 cent each four ounces or fraction thereof....	No limit.
Third Class—Books, circulars, pamphlets and other matter wholly in print. Proofsheets, corrected proofsheets and manuscript copy accompanying them.....	1 cent each two ounces or fraction thereof	4 pounds, except single books weighing in excess of that amount.
Fourth Class—Merchandise and matter not included in any of the above classes.....	1 cent each ounce or fraction thereof.....	4 pounds.

Registered Mail, Domestic.

Fee, 8 cents per letter or package. Postage additional. *All valuable mail matter should be registered.* While the Post Office Department is not legally liable for the loss of registered mail matter, every possible precaution is taken to insure its safety. Special security is given registered matter by the use of a distinctive official cover; by its retention in special custody and by a system of records and receipts showing each transfer throughout its journey from the hands of sender to those of the addressee.

(NOTE.— In 1897 a bill was introduced in Congress, and passed by both houses, granting an indemnity to the amount of $10 for the loss of a registered article while the same was in the custody of the Post Office Department. This law is inoperative, because the necessary appropriation to carry out its provisions was not made by Congress. It is reasonably certain that the required appropriation will be made by the present Congress, when the law will at once go into operation.)

Foreign Postage Table.

The rates of postage to all foreign countries and colonies (except Canada and Mexico), are as follows: Letters, per 15 grams (½ ounce), 5 cents; single postal cards, each, 2 cents; double postal cards, each, 4 cents; newspaper and other printed matter, per 2 ounces, 1 cent.

Commercial Papers.— Packets not in excess of 10 ounces, 5 cents; packets in excess of 10 ounces, for each 2 ounces or fraction thereof, 1 cent.

Samples of Merchandise.— Packets not in excess of 4 ounces, 2 cents; packets in excess of 4 ounces, for each 2 ounces or fraction thereof, 1 cent.

Registration fee on letters or other articles, 8 cents.

Ordinary letters for any foreign country (except Canada and Mexico) must be forwarded, whether any postage is prepaid on them or not. All other mailable matter must be prepaid at least partially.

Domestic Money Orders.

The printed application form must be used.

A money order cannot be made payable to more than one person or firm.

DOMESTIC MONEY-ORDER FEES.

For orders of $2.50 or less	3c			Over $30.00 and not exceeding	$ 40.00,	15c	
Over $ 2.50 and not exceeding	$ 5.00,	5c		" 40.00 " "	50.00,	18c	
" 5.00 " "	10.00,	8c		" 50 00 " "	60.00,	20c	
" 10.00 " "	20 00,	10c		" 60.00 " "	75.00,	25c	
" 20.00 " "	30.00,	12c		" 75 00 " "	100.00,	30c	

FIREPROOFING AS APPLIED TO RESIDENCES AND APARTMENT BUILDINGS.

The question of fireproofing as applied to store and office buildings has for some years past been very carefully studied, but demonstrations of recent fires in Chicago and other cities prove that there is room for improvement. Imperfect insulation of the steel or iron framing by the fireproofing or covering of the metal or wood used in construction should be easy to remedy by a closer attention to the covering used and proper provision made for sufficient space between the metal or wood. If, as it is conceded to be, fireproofing is a very important factor in office, store or manufacturing buildings, how much more so is it necessary to be adopted in apartment buildings, ho-pitals (public and private), residences and school buildings.

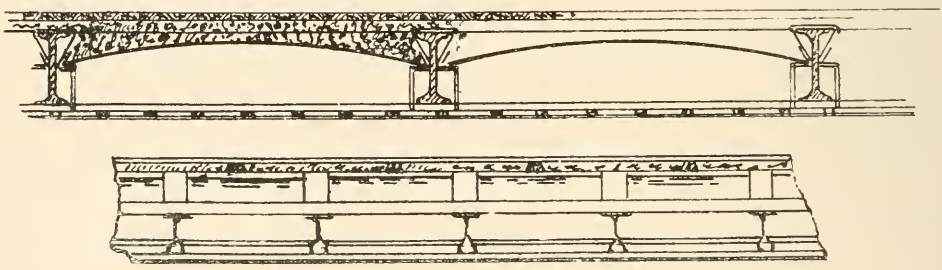
Among the dangers menacing the public may be named, imperfect and poorly constructed heating apparatus, light shafts, defective gas pipes, gasoline stoves, accumulation of rubbish and waste paper, and then in case of even incipient conflagration the difficulty and in many cases, the impossibility of escape, owing to the open stairways without sufficient protection. It is true the amended building ordinance provides against some of the dangers, and if strictly enforced much good should result.

The building with its heating apparatus is often in charge of a man who is careless and incompetent. The principal obstacle seems to be the question of cost to many owners of property who are, and would be, desirous of providing buildings that may not be called strictly fireproof, but that will at least offer such obstruction as to effectually prevent the spread of fire.

Various methods are offered; some of them merit fair consideration, and a few suggestions are now offered.

First. The basement floors should in all cases be of concrete covered with a smooth surface of Portland cement, care being taken to secure proper drainage.

Second. The floor above should have I-beams of proper size and spaced sufficiently to carry the loads. The ceiling should be formed of stiffened wire cloth securely wired to steel rods suspended from the beams. The floor above to be formed by wire cloth sprung between flanges and stiffened by steel rods, then covered with concrete up to one inch of the top of floor strips imbedded in the concrete. The finished floor to be laid on them. (See sketch.)



Third. Partitions of hollow tile, laid in mortar, of 2, 3 or 4 inches thick, as may be desired. These, with all ceilings, to be well and carefully plastered with good hard plaster, and finished as required. No wood lathing nor studding.

STAIRWAYS.— The most important part of the structure should be inclosed in brick walls, only the necessary openings being allowed on each floor, and if in buildings over four stories, where elevators are provided, the stairways should be placed as far as possible from them, and not, as is too often the case, around them. Those stairways leading to basement would be safer if isolated from those above.

The writer recently visited a large hospital in this city which is five and in some parts six stories in height, and provided with three elevators inclosed with wire netting, extending from the basement to the top floor, the only stairways provided being around each elevator. A fire occurring, say in the basement, would in all probability prevent egress from the several floors.

Cost.—The cost of such fireproofing, as suggested, above the ordinary floors and ceilings need not exceed ten per cent. Floors with 2 by 12 joists, sized and bridged, and *double* floors and proper deafening will cost, complete, about 15 cents per square foot. Floors and ceilings, with iron beams, concrete, wire cloth and finished complete not to exceed 25 cents per square foot, and in a building costing, say $40,000, of ordinary construction, by using tile partitions, fireproof flooring and ceilings, would cost not to exceed $44,000, thus securing a building far more lasting. With no ugly cracks from shrinkage of timber, doors and windows would remain in shape and give a feeling of confidence and safety to both tenants and owners.

In many of the apartment houses of this city large sums are expended on the exterior and the entrances, mosaic floors, handsome carved interior finish in marble and fancy woods. All these desirable surroundings in no way compensate for the dangers liable in many buildings that are little better than firetraps.

Sidney Smith, Architect.

MINERAL WOOL—ITS MANUFACTURE AND USES.

Mineral wool is a vitreous substance converted to a fibrous condition. In appearance it consists of very fine fibers interlacing each other in every direction, thus forming an innumerable number of minute air cells. The resemblance of these fibers to those of wool or cotton has given to the material the name, but it is only in appearance and softness that any similarity exists between the mineral and the organic fibers. It appears in a variety of colors, principally white, but often yellow or gray. The quality of the wool is not at all dependent upon, or affected by, its color. It partakes of the nature of glass without its brittleness, the fibers being soft, pliant and inelastic. It is made by converting blast-furnace slag and certain rocks while in a melted condition to a fibrous state. In converting the vitreous substance into mineral wool of the ordinary grade it is found that the material increases in bulk twelve times, so that the resulting fibers incase twelve times the quantity of air that the material did before conversion.

ITS PROPERTIES.

Insulation of Heat.—One of the most important qualities of mineral wool is its unequaled power to resist the transmission of heat and cold. Mineral wool holds in confinement a greater proportion of air than any other material. So long as air is circulating at all, it is carrying heat from one place to another. An air chamber, whatever its size, if sufficient to permit any movement of the air, fails as an insulator of heat. If the air-confining material is not loose and porous and of small percentage as compared with the volume of air it incloses, the incasing material itself will transmit heat.

Protection Against Frost.—Closely allied to the subject of heat insulation is the very important question of frostproofing. In protecting water pipes from freezing, it has been eminently successful where all other means have failed. Its free use for this purpose will relieve the householder and manufacturer from serious annoyance. A thickness of three inches of mineral wool and upward, according to the exposure, is recommended.

Fireproofing.—Mineral wool is noncombustible and practically indestructible by heat. So long as inflammable material is used in the construction of buildings they cannot be made entirely fireproof; but even when constructed prin-

cipally of wood, they may be made to burn very slowly by its use, and great security against fire be thus effected. If the spaces between timbers are filled with it, should a fire get started in the building the flames cannot spread through hidden passages, but can only progress as they work their way, exposed to sight, along the outer surface of the walls and floors.

Insulation of Sound.—It possesses special value as a nonconductor of sound. Its elasticity and want of solidity prevents the transmission of sound through it, and the material is coming more and more into use as a "deadener" or "deafener." As sound is communicated by the actual contact of beams, and especially by the vibrations of the air between them, it can well be understood how a porous material like mineral wool will have a muffling influence on the solid parts of the building, and so occupy the space that wave motion will not be possible.

Protection Against Rats, Mice, Insects and Disease Germs.— The analysis of mineral wool shows it to be a silicate of magnesia, lime, soda, alumina and potash. It is plain there is nothing organic in the material to decay or become musty; or to furnish food and comfort to insects or vermin. All past experience shows that houses lined with mineral wool will not become infected with animal life.

The use of mortars or earths to imbed floor timbers for deafening or other purposes is generally followed by the dry-rotting of the wood. This never occurs in connection with the use of mineral wool.

its uses.

Mineral wool is being put to new uses day by day. It is, however, especially valuable as applied to buildings.

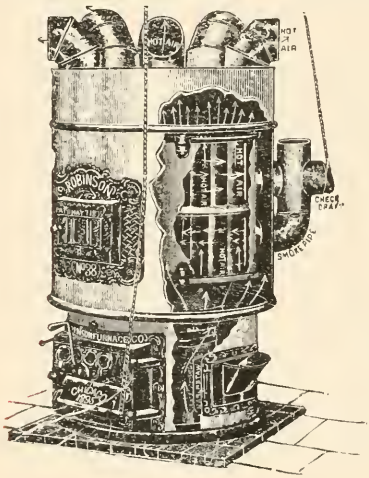
The cost of filling the outside walls of a house would be from $75 to $200, according to the size of the same.

It is used very largely by builders of cold-storage buildings, creameries, packing houses, breweries, in houses, and, in fact, all buildings needing insulation against heat.

As a deafener of sound it is invaluable, and it is used in hospitals, asylums, schoolhouses, public halls, theaters, hotels and apartment buildings.

A filling of this material in the roofs of dwellings or other buildings will preserve the upper rooms from the heat of the summer sun or the cold in the winter.

In estimating the quantity of this material needed, it is safe to calculate one pound per square foot for each inch in thickness, and it can be purchased for about 70 cents per hundred pounds of dealers.



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CHICAGO BUILDING TRADES BUREAU OF INFORMATION.

GEORGE K. THOMAS, Manager.

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This Bureau was incorporated in August, 1897, for the purpose of supplying information to architects, contractors and material men. It enables architects to ascertain the responsibility and the past record of those who seek work in their offices. It is of value to reliable and experienced contractors, because it keeps them in touch with architects who have work to be figured and want competent men to do it at fair prices. To further the attainment of the purpose for which this Bureau was organized, is added the earnest recommendation of architects that all contractors be required to give the bond of a reliable surety company to secure the performance of the work which they undertake.

It is not deemed necessary to call attention to the fact that this will be of great service to the different building trades by eliminating from the field that class of irresponsible builders who have been preying on the public to the detriment of the more responsible firms and the building industry in general. The architect is thus relieved of his statutory responsibility, and the burden of investigating private bondsmen. The irresponsible bidder will find that he must pay the penalty. The rapid growth of Chicago makes it imperative that there should be in existence a reliable and accessible record of those who have made successes and failures of the contracts which they have undertaken.

Architects may obtain this information at all times, free of charge. Contractors make their own records.

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STEAM AND HOT WATER HEATING.

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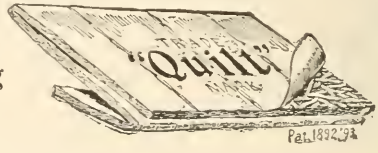
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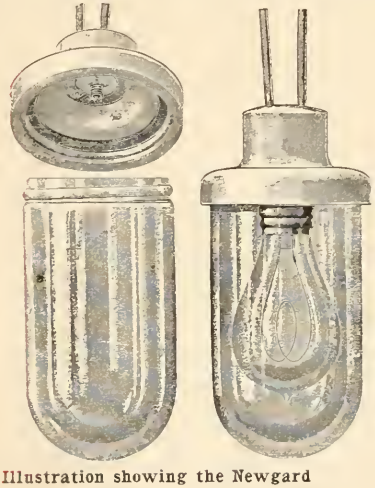


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